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P. M. D. SANDERSON, F.Z.S., S. H. PRATER, C.M.Z.S.
& SALIM A. ALI, M.B.O.U.

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ERRATA

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Page 514, line 1 for *furruginea* read *ferruginea*
,, 558 ,, 38 for *chenchris* read *cenchris*
,, 566 ,, 20 for *Cicona* read *Ciconia*
,, 566 ,, 30 for *Cotyle* read *Cotile*
,, 656 ,, 10 for *Pyrrospiza* read *Pyrrhospiza*
,, 656 ,, 9 from bottom *for* Allen Hume *read* Alan Hume
,, 659 ,, 2 for *Octocris* read *Otocoris*
,, 749 ,, 1 for *fulginosa* read *fuliginosa*
,, 749 ,, 38 for *musicapa* read *muscicapa*
,, 749 ,, 42 for *musicapa* read *muscicapa*.

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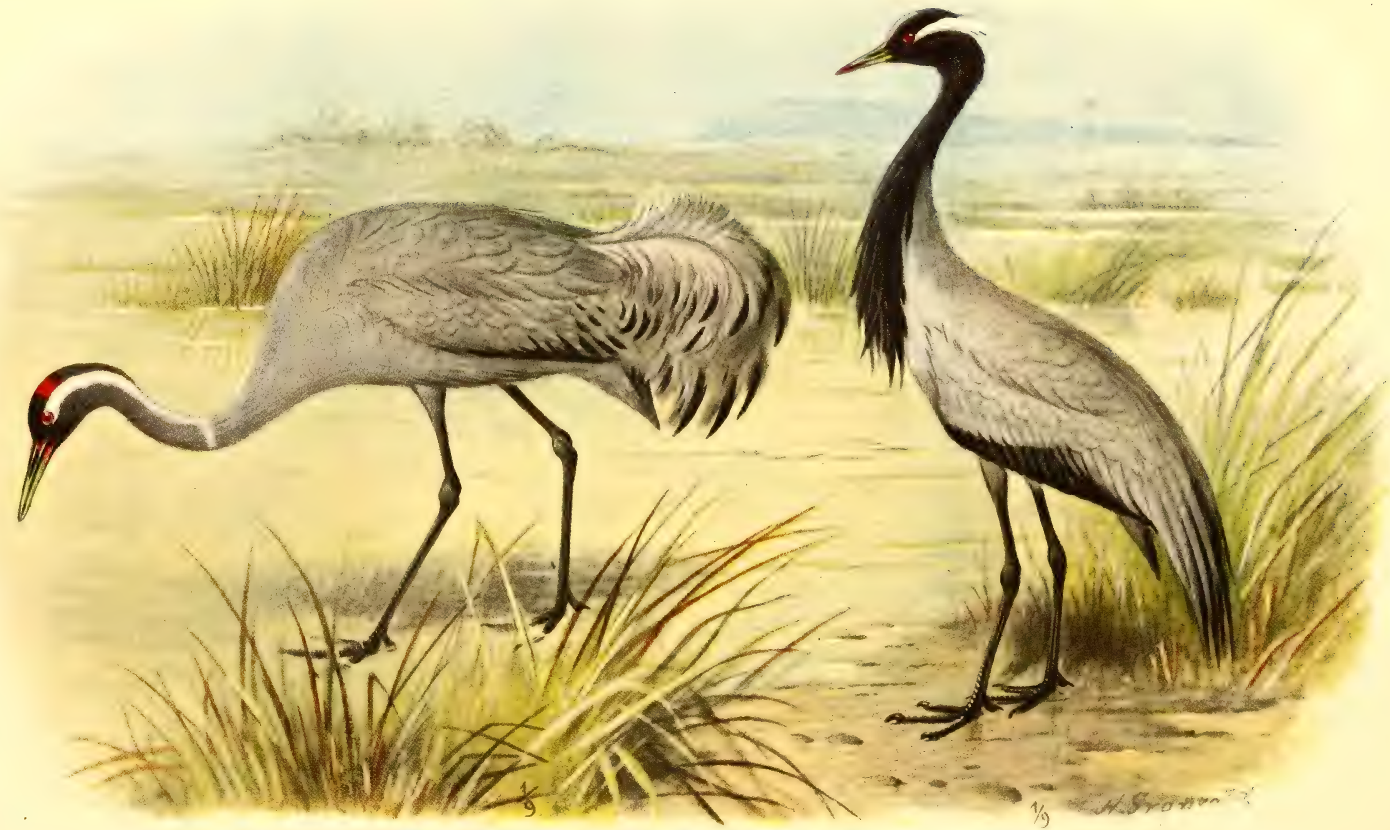

THE EASTERN COMMON CRANE
Megalornis grus lilfordi
1/9 Nat. size.

THE DEMOISELLE CRANE
Anthropoides virgo
1/9 Nat. size.

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THE GAME BIRDS OF THE INDIAN EMPIRE

BY

E. C. STUART BAKER, F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

VOL. V

THE WADERS AND OTHER SEMI-SPORTING BIRDS

PART V

(*With a coloured plate*)

(*Continued from page 245 of this Volume*)

SUB-ORDER BALEARICÆ

FAMILY BALEARICIDÆ

CRANES

The True Cranes are birds of large size with long necks and legs but with a bill only equal to, or but little longer than, the head. The nostril is enclosed by a membrane on the posterior side and it is placed in the base of a groove which extends about half-way up the upper mandible. There are 12 tail feathers and 11 primaries. The tracheæ pass into a hollow space between the long walls of the sternal keel and are more or less convoluted.

Our Indian Cranes were divided by Sharpe into the genera *Grus*, *Sarcogeranus*, *Antigone* and *Anthropoides*.. The name *Grus* is not tenable and has to give way to *Megalornis*, whilst the differences between this and *Sarcogeranus* seem hardly generic. On the other hand *Antigone*, not recognized by Blandford, is now generally accepted as sufficiently defined to form a good genus.

KEY TO GENERA

A. Crown of head bare; sides of head and upper neck feathered ... ... *Megalornis*.
B. Crown of head bare, sides of head and neck not feathered ... ... *Antigone*.
C. Crown of head feathered ... ... *Anthropoides*.

Genus—ANTHROPOIDES

Anthropoides.—Vieill., Analyse, p. 59, 1816.

Type.—*Ardea virgo* Linn.

In this genus the head is feathered throughout and there are long white plumes springing from behind the ear-coverts; the feathers of the lower neck are long and lanceolate, whilst the inner secondaries are much lengthened but not disintegrated as in *Grus*. The bill and legs are shorter in proportion than they are in that genus.

ANTHROPOIDES VIRGO

The Demoiselle Crane.

Ardea virgo Linn., Syst. Nat., 10th ed., i, p. 141 (1758). (*In oriente.* Restricted to India).

Anthropoides virgo. Blanf. and Oates, iv, p. 190.

Vernacular names.—*Karkarra* (Hind.); *Ghants* (Nepal); *Karkuchi* (Mahr.); *Kallam* (Deccan); *Garara* (Uriya); *Wada-Koraka* (Tel.); *Kar-koncha* (Can.)

Description.—Forecrown to nape grey; patch below the eye, a line over the ear-coverts and long aigrette behind them pure white; remainder of head and neck black, the feathers of the lower foreneck very long and lanceolate falling over the breast; winglet, greater coverts and wing quills blackish; ends of lengthened inner secondary plumes black, grading into the pale French grey of the rest of the plumage; the grey of the upper plumage extending on to the base of the hind neck.

Colours of soft parts.—Iris red-brown (possibly young birds) to crimson or red; bill sage-greenish with a red tip; legs and feet black.

Measurements.—Wing 450 to 530 m.; tail 165 to 182 m.; tarsus 170 to 187 m.; culmen 65 to 70 m.

Young birds are like the adult, but have the head wholly grey; the black of the neck is browner behind, more grey in front, and there are no lengthened plumes; wings coloured as in the adult but the inner secondaries but little lengthened.

Distribution.—Breeding in Southern Europe and the high plateaus of Algeria; Central and Northern Asia as far East as Western Mongolia. In Winter south to Northern Africa, Mesopotamia, Palestine and India. In the last-mentioned country it has occurred south as far as Kollegal in Coimbatore, but is rare south of the Deccan. East it extends through Eastern Bengal and Assam to the greater part of Burma, but it is not common east of Bihar.

Nidification.—No better description of the breeding of these beautiful cranes exists than that given by Dr. A. S. Cullen in his account of the Nesting of Birds in Bulgaria, though it is to be feared that the birds no longer exist in such great numbers.

> "This bird arrives in the Dobrudsha in about the second week of April. It makes its appearance in flocks of from twenty to thirty birds and upwards, and the form of these flocks very much resembles those of the Common Crane, and they almost always fly very high, especially when passing wooded country;

but when crossing the plains they fly lower, and occasionally come within gunshot. For the first week after their arrival flocks of these birds mingle with those of the Common Crane, and resort to any fields of newly-sown grain that they can find, and to these they often do great damage. Regularly once or twice during the day they repair to some lake or pond of fresh water to drink. In the evening the fields are deserted, all the birds going to the nearest lakes or marshes, where, I believe, they remain all night. About the second week after their arrival the flocks break up into pairs, which disperse themselves all over the country. Very soon after the birds have paired they begin to lay. Eggs may be found from about the third week in April to very nearly the end of May; but much depends on the state of the weather. The nest of the Demoiselle Crane is, without exception, made on the ground, usually amidst some kind of young grain, but often amongst grass on fallow land, and now and then, though more rarely, amongst stubble. The nest—if indeed such it can be called—is made by the birds pulling up or treading down the grain, grass, or stubble for the space of about two feet, and scratching the shallowest possible hollow in the middle of the bare patch thus formed. A few small straws and stones are often found in and about this hollow, but whether they are brought there by the birds, or found there by them, which is very probable, I cannot say with any certainty."

"I believe myself, however, that they are placed there by the birds. The eggs, which are never more nor less than two in number, are *always* placed side by side, in the hollow already described, with their small ends pointing in the same direction. The male assists the female in hatching the eggs; indeed, I have every reason to think that he sits as much as the female. To the uninitiated in the habits of this bird, its eggs are very difficult to find. When an intruder approaches the spot where the eggs lie, he at first sees nothing except perhaps a solitary bird standing on one leg as if sleeping. Should he not be a very good observer, as he draws nearer he will probably only notice a pair of birds walking rapidly away, plucking the grass as they go, apparently feeding eagerly, and he will most likely account for the sudden appearance of the second bird by concluding that it had been sitting on the ground resting, and will not think anything about the matter, and pass on. Very few persons indeed would at all suspect that the birds had a nest. Often, nay, almost always, when the birds have placed some distance between them and their nest, they will take flight, and to all appearance desert the spot altogether, but no sooner is the intruder's back turned, than there they are again in a wonderfully short space of time. One of the birds, I believe the male, always keeps watch over the other, except in the middle of the day in very hot weather, when the bird, which acts as sentinel, deserts its post and goes to the nearest pond or lake to drink. It does not, however, remain away very long."

> " Should the bird whose place it is to watch while the other sits be absent, the sitting bird when disturbed is not quite so guarded in its movements, and will allow a much nearer approach. When the eggs are first laid the birds will leave them as soon as an intruder comes in sight, but as the incubation advances they become less shy, and will not leave their eggs so readily.
>
> " I cannot say whether the bird which watches stands close to or a little distance from the nest. I rather incline to the latter opinion. If a crane be observed chasing other birds away from any particular spot, it is a sure sign that it has a nest not far off. This bird will give chase to eagles and great bustards without the least fear, should they venture near its nest. For all kinds of harriers and seagulls it has a great dislike. I have been told by the Tartars that, should a dog by chance go near the nest of this bird, both the birds will attack him, striking him with their beaks and wings, and making a great noise all the time. I myself have never had an opportunity of witnessing such an interesting encounter, but I am certain that this bird has sufficient courage for one. The Demoiselle crane is easily domesticated when young."

Dybowski says that in Dauria " it nests on the rocky banks of rivers and rarely on bare mountains. The nest is made of small stones fitting close to each other, the surface of the nest is flat or deepening somewhat towards the centre ; it chooses sometimes a place which is a few inches higher than the surrounding ground, and fills up all the crevices and openings with stones."

The breeding season lasts from the middle of May to the middle of July, a month earlier in its most southern breeding haunts, even later in the more northern. The normal clutch of eggs is two only, but three are occasionally laid. In appearance generally they are small replicas of those of the Common Crane, but they are still longer and more narrow in proportion to their size. The ground colour varies from a pale olive yellow to a warm olive brown or olive green whilst the markings consists of large primary blotches of brown or purple brown and secondary blotches of neutral tint of pale purplish-lavender. In most eggs these are fairly numerous over the whole surface, but in some they are confined to the larger end where they form an indefinite ring or cap. One hundred and twenty eggs average 83·3 × 53·1 mm., maxima 91·4 × 55·1 and 84·2 × 56·6 mm. ; minima 74·1 × 48·5 and 78·0 × 47·0 mm.

Habits.—The Demoiselle Crane arrives in India in October and the first flocks which arrive seem to fly straight down to their southern limits as it is said to arrive in the Deccan in the middle of October, whilst in the north few birds seem to settle until the end of that month, though they must pass over on their way south. They return North in March and April, Whistler recording numerous flocks from the Jhang District between March 8 and April 7. Both coming and going they assemble in vast multitudes, and a most interesting letter from Mr. A. A. Phillips, quoted by Whistler, gives a graphic account of one of these assemblies :

> " On March 25, C. and I went out after them. They were a sight worth seeing and hearing. There seemed to be vast

> divisions of them about, but we only *shikared* one division: while they were feeding on the ground there was a broad band of them for about 1½ miles. When alarmed they bunched together and looked just like a white pebble beach about 100 by 500 yards in extent, and when they rose the noise was like the roaring of the sea. We shot three which were all Demoiselles."

The dancing of this Crane is well known, Nordmann's description having been translated by Bree, as follows :—

> "They arrive in the South of Russia about the beginning of March, in flocks of between two and three hundred individuals. Arrived at the end of their journey, the flock keeps together for some time ; and even when they have dispersed in couples, they reassemble every morning and evening, preferring in calm weather to exercise themselves together, and amuse themselves by dancing. For this purpose they choose a convenient place, generally the flat shore of a stream. There they place themselves in a line, or in many rows, and begin their games and extraordinary dances, which are not a little surprising to the spectator, and of which the account would be considered fabulous were it not attested by men worthy of belief. They dance and jump around each other, bowing in a burlesque manner, advancing their necks, raising the feathers of the neck-tufts, and half unfolding the wings. In the meantime another set are disputing in a race the prize for swiftness. Arrived at the winning-post they turn back, and walk slowly, and with gravity; all the rest of the company saluting them with reiterated cries, inclinations of the head, and other demonstrations, which are reciprocated. After having done this for some time, they all rise in the air, where, slowly sailing, they describe circles, like the swan and other cranes. After some weeks these assemblies cease, and from that time they are constantly seen walking in loving pairs together."

In flight and voice these cranes are very similar to the Common Crane ; they migrate in broad V shapes or in long waving lines, and their call is a beautiful sonorous trumpet, somewhat less loud perhaps than that of *Megalornis grus*. Vidal says that they are very slow rising off the ground, and considers the best way to get a shot at a flock is to walk straight up to it without concealment, "and immediately the first bird flaps his wings preparatory to taking flight, to run as fast as ever you can, straight at them. If you have any breath left in you, after a short spurt of 60 or 70 yards you are almost certain of a shot at the fag-end of the flock within killing distance."

Most people, however, who shoot cranes do so from behind the cover of a cart or of a led bullock, or if there be high crops about, by stalking them under cover of these. They are extremely wary, clever birds and, whether it is desired to shoot or trap them, they are very difficult to bring to bag. They are, however, sometimes caught in nets and, less often, in nooses, and when once caught soon become affectionate pets, but they are very jealous of other pets and jealous and irritable with small children.

As an article for the table the Demoiselle ranks very high, some people considering it the best of all Indian Game-Birds. They feed almost entirely on shoots, seeds and young crops, but also eat insects, small reptiles, etc.

Genus.—MEGALORNIS

Megalornis.—Gray, List Gen. Birds, p. 85, 1841.

Type.—Ardea grus, Linn.

In the genus *Megalornis* the crown of the head is bare but the sides of the head and neck are feathered and not bare as in *Antigone.* The wings are long with the inner secondaries lengthened and considerably exceeding the primaries ; tail short ; the tibia naked on the lower half ; toes short and strong with short, blunt claws. The sexes are alike in plumage.

Cranes are almost cosmopolitan in range, three genera and five species being found in India.

KEY TO SPECIES

A. Plumage grey, tail grey.	
(*a*) Throat grey ; white on neck confined to a line down the sides	*M. grus.*
(*b*) Throat white ; greater part of sides and back of neck white	*M. monachus.*
B. Plumage grey, tail black	*M. nigricollis.*
C. Plumage white	*M. leucogeranus.*

MEGALORNIS GRUS

Ardea grus Linn., Syst. Nat., 10th ed., 1, p. 153.

Type locality.—Sweden.

The typical form differs from our Indian bird in its darker plumage more especially in the colour of the inner ornamental secondaries.

MEGALORNIS GRUS LILFORDI

The Eastern Common Crane

Grus lilfordi Sharpe, Cat. B. M., xxiii, p. 252, 1894 (E. Siberia).

Grus communis. Blanf. and Oates, iv, p. 186.

Vernacular names.—*Kurunch*, *Kurch* (Hind.) ; *Kunj* (Sind) ; *Kullam* (Deccan) ; *Kulangi* (Tel.).

Description.—Lores and crown to nape bare black skin with scattered black hairs ; a broad band of bare skin brick-red to red, across the nape, the black hairs even more scarce than on the crown ; a patch of grey feathers behind the bare red spaces ; sides of face grey ; ear-coverts, sides of head and neck white running back behind the grey neck patch and down the hind neck ; winglet, primaries, the terminal portions of the primary coverts and the tips of the long secondaries black ; chin, throat and foreneck dark slaty brown ; remainder of plumage pale, almost silvery grey ; tail slightly darker grey, blackish towards the tip.

Colours of soft parts.—Iris orange-red to red-brown or crimson ; bill dull glaucous or dingy green, paler and more yellow towards the tip; legs and feet black, the soles paler, more brown, greenish or even fleshy.

Measurements—Wing 533 to 608 mm.; tail 192 to 205 mm.; tarsus 225 to 258 mm.; culmen 103 to 118 mm.

Young birds have the edges of the grey feathers isabelline or rufescent isabelline; the sides of the head and neck and hind neck pale rusty rufous; feathers cover the red bare skin on the nape whilst the crown also is more or less covered with the same; the drooping inner secondaries are wanting.

Half-grown birds have the edging to the feathers more rufous and more conspicuous and the whole crown and neck clothed with rusty coloured feathers.

Chicks in down are pale golden fulvous above: a broad line of deeper tint runs down the centre of the back and two narrower, less defined lines from the wings down each side of the body; centre of crown and a mark above the eye dark golden rufous; below sandy buff, albescent on the chin and foreneck and pale on the centre of the abdomen.

Distribution.—The Eastern Common Crane breeds in Eastern Siberia from the Yenesi basin eastwards and in Turkestan. In winter south to China and practically the whole of Northern India. It is extremely common in North-west India and extends south through the greater part of the Bombay Presidency and the Deccan. It has occurred in Southern Orissa and I have seen it as far East as Lakhimpur and Cachar in Assam on several occasions.

Nidification.—There is very little that I can find on record in regard to the breeding of the Eastern form of the Common Crane H. E. Dresser had eggs which he received from the Russian collectors round about Tomsk which is considerably to the West of the Yenesi. Of these he merely says that they differ in no way from the European bird and that their breeding habits are similar. I have also two pairs of eggs in my collection collected by Smirnoff north of the town of Yenesi and on the east of that river. A brief note which accompanies the eggs says: "These birds breed in small communities of half a dozen or so, the nests being placed on the ground from 50 yards to half a mile apart, sometimes two quite close together. The nest is a big untidy one made of all kinds of things which the birds pick up from the ground such as rushes, moss and lichen and other scraps. It is sometimes quite high, as much as a foot whilst across it sometimes measures over a metre. The eggs always number 2."

The sort of country it selects as a breeding site is nearly always such as contains swamps and lakes and it is said by Burturlin to sometimes breed on the extreme edge of the lakes in among the rushes and reeds, probably however, more often it breeds on marshy ground some little distance from the lakes themselves.

The only eggs I have seen of this race have all been laid in May or early June but they are said to breed sometimes as late as the last week of the latter month. The eggs could not possibly be distinguished from those of the Common European Crane. In shape they are rather long drawn-out ovals, the smaller end blunted although distinctly smaller than the other end. The texture is rather coarse but the surface is quite smooth though with little, if any, gloss and the shell is stout though not particularly so for such large eggs. The ground colour varies from a pale greenish-grey or yellowish-grey to olive or yellow brown and the whole surface is sparingly marked with reddish-brown streaks and blotches with other secondary markings of paler tints of the same and dull lavender grey. Occasionally an egg is found with rather darker browner markings.

Six eggs average 93·8 × 59·6 m., maxima, 95·2 × 95·0 m.; minima 90·2 × 57·0 m.

Burturlin gives the breeding distribution of the eastern form of the Common Crane as Altai, Turkistan, Dauria to Manchuria and north from Siberia to the 66th degree of latitude.

Habits.—In India, the Common Crane is only known to us as a winter migrant, arriving generally about the second or third week in October; Hume records their arrival on one occasion as early as October 3, whilst Doig says that in Sind, many birds arrive as early as the end of August, though this must be very exceptional. They begin to leave again by the middle of March, the bulk of the birds moving about the end of that month and a few staying on until the end of April. These late birds Hume thought were young birds not anxious to breed and therefore not leaving as early as the old ones. In the east of India the few Cranes that are to be seen arrive in November and I do not think that I have ever seen them after the second week in March. In North-west India they are often found in very great numbers said sometimes to be in many hundreds.

The Crane is undoubtedly one of our most wary game birds and one of the most difficult to approach within gun shot.

Colonel Tickell refers to this bird and gives a most interesting account of their habits which is quoted by Blyth in his monograph on the Cranes. He says:—

> " In serene weather in the cold season, when, though the skys are cloudless blue, the mild atmosphere enables the sportsman to roam all day long over miles of far-reaching plains, the sonorous trumpet call of the Crane is one of the most familiar sounds that meet the ear. The cry resembles the syllable 'kurrk' a single loud brassy note, harsh and metallic, but mellowed by the vast distance at which it is generally heard. At such times the birds may be seen high in the air, advancing in an angle or in a single diagonal line winnowing their way across the pathless vault to distant regions, or soaring round and round in irregular swarms, and independently, as if reconnoitring the country below to select a fit place for their nocturnal meal. When thus employed sometimes two or more parties meet, and the clamour amongst them then becomes extreme, like the mutual clacking and cackling of assembled geese. Should the country, as beforesaid, be quite open, and no human being be observed moving on the plain, they will sometimes descend to the ground in the day-time, and on such occasions the downward sweep, from a height of perhaps a mile in the air to the face of the earth, of two or

three hundreds of these large birds, is a majestic spectacle, though of necessity only to be seen from afar."

"I once, indeed, met with a striking exception to this wary habit of the Crane in keeping, during the day, out of gunshot in the air. In January, 1845, as I was one day riding along the Trunk road (as the old Government road from Calcutta to Delhi is called), in the district of Manbhoom, near the village or Chowkee of Niamutpoor, I came in sight and within point blank bail shot of a host of these birds collected in a rice stubble field. There was a prodigious concourse of them amounting probably to a thousand. They were making a deafening clamour and seemed in great agitation, while every now and then a party of them would take wing and fly off, generally to the eastward, towards the Damoodur River, but many went in other directions. The country in the vicinity was open and wild, with bushes scattered about, and here and there a cultivated patch; the hour early in the morning, by sunrise they had all disappeared. I was told by the villagers that as night fell the birds would return and re-assemble in the same spot, and that they had been in the habit of doing so for many years. I confess I was never more astonished at anything within the circle of Ornithology than at this instance of exception to the wild and wary habits of the Crane. They could not have assembled in the field (which was not a large one) to feed, as the grain in the stubble would not have afforded a night's meal to a tenth part of the flock. The most probable conjecture is that they fed elsewhere during the night, as is the wont of the bird and repaired to that particular spot to rest till dawn, congregating in separate and independent parties. But why they should have collected night after night and have stopped so near a village, and so liable to approach, is inconceivable. The people of the vicinity are, it must be noted, no shikaries and the report of a gun was probably a sound almost unknown in that part of the district. The Crane, like most waterfowl, feeds at night, more as a matter of precaution than by choice. No such nocturnal habits are perceived in tame individuals, nor, is it probable, in the wild steppes of Tibet or Siberia, where these birds breed unmolested and roam about free from the sight even of a human being."

"In India, after filling their crops with the gleanings from the rice and vetch stubbles, the Cranes retire at or soon after sunrise to sand flats or islets in large rivers, or to open downs inland, where no coverts afford means of approach to an enemy. And there they may be seen through a telescope, preening themselves, lazily stretching forth their legs or wings, or sitting dozing on their heels. One or two, however, keep on the alert, their heads raised high; and these, to judge by their size and flowing plumes, are old males."

As we have already seen the Crane is a magnificent flier, one with great power and endurance and also capable of carrying out both graceful and intricate evolutions at pleasure. It is also a fine runner and a wounded bird will often give its would-be captors a long chase before success crowns their efforts, indeed on marshy ground a second shot is generally necessary to bring to bag a bird that is merely winged. He is also a good swimmer but takes to water of swimming depth only under pressure, though they are very fond of wading about in shallow water when there is a supply of food to tempt them. The Common Crane, like all cranes, when only wounded, will put up a very fierce resistance to capture, striking viciously with the bill but, as Hume points out, a very slight tap with a stick on its long slender neck is quite sufficient to place it *hors de combat*. Hume gives a remarkable example of the force with which a Crane shot dead falls to the ground He writes: "As we walked back to the boat we became aware that an enormous flock of Cranes that had been trumpeting all the while, were practically over our heads. I wanted to unload my big gun and so fired at random straight up. I had hardly recovered from the recoil when a peculiar rushing sound caught my ear (luckily the sound outsped the bird), I just started back to listen when with a 'scrush' a dead bird plopped on the ground at my feet. The Crane had fallen back downwards, the shoulders first striking the ground and was firmly embedded in the clay. We pulled it out and found a basin-like depression in the ground, as far as I could judge in the dark, fully 8 inches deep in the deepest part."

Cranes feeding as they do so much in cultivation, very soon get used to the cultivators moving about in their small carts or with their bullocks and frequently do not trouble to keep out of gun-shot of these familiar objects. Accordingly, advantage is taken of this both by Indian and European sportsmen who approach under cover of bullock cart or bullock and thus get shots at birds which it would be otherwise impossible to approach. At other times birds may be driven towards the sportsmen but to do this with any success a few beaters only must be employed and these must know their work well. For a line of beaters to walk straight towards the birds is merely a signal for the latter to rise *en masse* and to take their departure high in the air and far out of shot of the gunners. If the birds are to be persuaded to fly over these latter within shot, the two or three beaters employed must slowly and apparently casually work their way up towards the birds so that these do not become really frightened, but gradually move along in the desired direction until finally they are within about 100 yards of where the sportsmen are hiding, when they may be startled into flight. A flock, however, once thus moved and shot at may be given up as hopeless for the rest of the day and if more birds are wanted, the sportsmen must move on to fresh ground.

Cranes are very omnivorous in their diet but probably on the whole prefer a vegetarian meal to any other. Different shoots of all kinds of crops, especially rice, are greedily eaten and in some cases, when the flocks are numerous and large, they cause considerable damage to crops. They are said to be especially fond of water melons and destroy even more of these than they eat. In addition to all kinds of aquatic plants, grain and shoots they will eat any small reptile and all kinds of large insects and it has been alleged that on occasions they even catch fish. They feed principally in the very early mornings and late evenings whilst, where they are much disturbed, they feed a great deal during the night, more especially when there is a moon. During the hot hours of the day they resort to the banks of rivers and tanks where they have a wide view all round them and there pass the time away dozing and often standing on one leg in shallow water with their head and neck tucked away into the feathers of the back. Directly they flight towards their feeding grounds Cranes become very noisy, constantly uttering a loud trumpet-like call but during the day they seem to keep more or less silent.

Like all their family this bird indulges in dancing during the breeding season and at odd moments even during the Winter months, when the attitudes, bowings and scrapings indulged in during these preformances are often very ludicrous.

A flight of these birds when moving for any distance is always carried out in regular formation, either a long line or a wide ' V ', the leader at the apex apparently changing place every few minutes with one of the other birds in the rear. When flying short distances from one feeding ground to another, this formation is not always observed and the birds move in indiscriminate flock.

(*To be continued*)

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY

BY

E. Blatter, s.j., Ph.D., F.L.S.

PART V

GRAMINEÆ

BY

E. Blatter and C. McCann

(*Continued from page 298 of this Volume.*)

27. Cleistachne, Benth. in Hook. Ic. Pl. xiv, 60, t. 1379 ; Stapf in Fl. Trop. Afr. ix, 154.

Tall, rather coarse grasses, annual according to Stapf, perennial according to Hook. f. Leaves long, narrow, flat, with stout midribs. Panicles narrow, more or less contracted, greyish or fulvously hairy. Spikelets solitary, all alike, hermaphrodite, pedicelled on the tough rhachis of racemosely arranged or panicled racemes, falling entire from the thickened tips of the pedicels. Florets 2, lower reduced to an empty glume, upper hermaphrodite. Involucral glumes equal, very similar, with involute margins, more or less coriaceous, delicately 7–9-nerved, muticous. Floral glumes hyaline, lower 2-nerved, upper 2-dentate or subentire, 3-nerved, with a twisted flexuous awn from the sinus or tip ; pale very minute, ciliate. Lodicules 2, broad-cuneate, sparingly ciliate. Stamens 3. Stigmas laterally exserted, plumose. Grain oblong to obovoid-oblong, very obtuse or truncate ; embryo half the length of the grain.

Species 3, one in West India and 2 in tropical Africa.

1. **Cleistachne Stocksii**, Hook. f. in F. B. I. vii, 163.

Description : Stem tall, stout, simple. Leaves 30–40 cm. by 12 mm., finely acuminate, softly hairy, midrib stout, margins slightly thickened, ciliolate, sheath terete, ligule oblong, coriaceous. Panicle 15–20 cm. long, long-peduncled, sub-erect ; rhachis and branches sparsely ciliate, pedicles of spikelets strigose with bright yellow hairs. Spikelets 5 mm. long, crowded, dark brown, callus short, bearded. Lower involucral glume dark brown, obscurely many-nerved, hirsute, shining, upper like lower, but narrower nearly glabrous. Lower floral glume 2-nerved, margins infolded, tip hispid, upper a twisted awn 16–25 mm. long, dilated at the base into a hyaline, entire, 3-nerved membrane, embracing the minute, ovate, obtuse pale.

Locality : Tungar forest, Bassein (Bhide !).

Distribution : So far only found in Malabar on the Bababoodan Hills.

28. Vetiveria, Thouars ex Virey in Journ. de Pharm. 1. ser., xiii, 499 ; Stapf in Fl. Trop. Afr. ix, 156.

Coarse, perennial, glabrous grasses ; rhizomes stout ; culms stout, more or less compressed below. Leaf-blades firm to hard, conduplicate in bud, then flattening out, at least upwards, gradually passing into the sheath ; lower sheaths much compressed, flabellate-imbricate. Panicles erect, long, of many-rayed whorls of slender simple or rarely compound racemes, glabrous except for the frequently bearded calli. Spikelets 2-nate, of each pair subsimilar, differing in sex, one sessile, the other pedicelled, on the articulate fragile rhachis of copiously whorled (rarely panicled) peduncled 3-to many-jointed racemes, the sessile spikelets falling with the contiguous joint and the accompanying pedicelled spikelet or at least the accompanying pedicel ; joints and pedicels slender, slightly and gradually thickened upwards. Florets 2, lower reduced to an empty glume, upper hermaphrodite in the sessile, male in the pedicelled spikelets. Sessile spikelet laterally slightly compressed, awned or awnless. Involucral glumes equal, lower more or less coriaceous or chartaceous with a broad rounded back and subinflexed margins, usually muticous, upper boat-shaped, keeled upwards, with broad hyaline ciliate margins, muticous, mucronate or aristulate. Floral glumes hyaline, of lower floret 2-nerved, of upper minutely 2-dentate, muticous or mucronulate or with a perfect or imperfect awn from the sinus. Pale minute, hyaline, nerveless. Lodicules 2 glabrous. Stamens 3. Stigmas laterally exserted ; styles subterminal. Grain oblong, slightly oblique at top. Pedicelled spikelet dorsally compressed ; involucral glumes much thinner than in the sessile, like the floral glumes usually awnless.

Species about 7 in the tropics of the Old World.

1. Leaves 5–13 cm. long. Panicle 15-18 cm. long ... 1. *V. Lawsoni.*
2. Leaves 30–90 cm. long, Panicle up to over 30 cm. long ... ... 2. *V. zizanioides.*

1. **Vetiveria Lawsoni,** Blatter & McCann, *nov. comb.*—*Andropogon Lawsoni*, Hook. f. F.B.I. vii, 187.

Description : Rootstock stout, horizontal. Stem erect, simple, slender, internodes very long. Leaves chiefly subradical, 5–13 cm. by 5 mm., exactly linear, rigid, curved, acute or obtuse, tips serrulate, base not contracted, margins ciliate, nerves 4–8, strong ; sheaths compressed, of lower very short, of cauline very long, striate ; ligule a ridge of hairs. Panicle 15–18 cm. long, narrow, elongate, branches or peduncles of spikes opposite and fascicled, branchlets slender, puberulous with a white scurf. Spikes 6–12 mm. long, pale reddish, erect ; joints 6-8, very obliquely truncate, tips obscurely ciliate, pedicels nearly equalling the spikelet, slender, compressed. Sessile spikelets 4 mm. long, linear-lanceolate, callus bearded with silky hairs. Lower involucral glume linear, rigid, coriaceous, tip obtuse, bristly, keels muricate, scaberulous margins inflexed, upper involucral glume cymbiform, tip 2-fid, awn longer than the glume, base ciliate, keel pectinately ciliate above the middle. Lower floral glume oblong, ciliate, nerveless, upper arched, linear, obtusely 2-dentate, awn very slender. Pale oblong, ciliate, nerveless. Anthers long. Pedicelled spikelets male, longer and narrower than the sessile, callus naked ; lower involucral glume 3-nerved, awned, keels pectinately ciliate, upper acuminate, awned. Floral glumes oblong, obtuse, ciliate.

Locality : S. M. Country : Dharwar District, very common (Sedgwick 2170 !) ; Dharwar (McCann A277 !).

2. **Vetiveria zizanioides,** Stapf in Kew Bull. (1906), 346-49, 362, in Fl. Trop. Afr. ix, 157.—*V. odorata*, Virey in Journ. de Pharm. 1. ser. xiii, 499.—*V. arundinacea et muricata*, Griseb., Fl. Brit., W. Ind. 559, 560.— *Phalaris zizanioides*, Linn. Mant. Alt., 183.—*Andropogon muricatus*, Retz., Obs. iii, 43 ; Roxb. Fl. Ind. i, 265 ; Grah. Cat. Bomb. Pl. 238 ; Griff. Ic. Pl. As. t. 139, f. 57, t. 155, f. 1 ; Dalz. and Gibs. Bomb. Fl. 302 ; Duthie Grass. N. W. Ind. 90, Fodd. Grass. N. Ind. 36, t. 24.—*A. Festucoides*, J. S. Presl in C. B. Presl Reliq. Haenk. i, 340.—*A. squarrosus*, Hack. (*non* Linn. f.) var. *genuinus*, Hack. in Monogr. Androp. 542-44.—*A. squarrosus*, Hook. f. (*non* Linn. f.) in F. B. I. vii, 186.—*A. squarrosus*, Cooke (*non* Linn. f.) in Fl. Bomb. Pres. ii, 991.—*Agrostis verticillata*, Lam. Ill. Gen. i, 162.—*Anatherum muricatum*, Beauv. Agrost. Expl. Planch. 15.

J. D. Hooker and Cooke and many others have followed Hackel in calling this plant *Andropogon squarrosus*, Linn. f. Stapf (in Kew Bull. 1906, 347) has explained that this name applies to quite a different plant : 'No notice was taken of Scheuchzer's description or of Petiver's and Du Bois's specimens, and when Linnæus, about 1770,[1] received the grass from Koenig he described it as something new under the name *Phalaris zizanioides*. Koenig, however, also sent specimens of the grass to Retzius, who published it as *Andropogon muricatus* [2] in 1783. This name, which was suggested by Koenig himself, was subsequently adopted by Roxburgh and most other botanists. More recently,[3] however, it has been replaced by *Andropogon squarrosus*, a name adopted by the younger Linnæus [4] for a plant, also communicated by Koenig, who found it

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[1] Linnæus, Mant. Alt. (1771), 183.

[2] Retz. Observ. iii (1783), 43.

[3] Hackel, Andropog. in DC. Monogr. Phaner. vi (1889), 542.

[4] Linn. f. Suppl. (1781), 433.

"circa Zeylonam natans supra stagna profundiora," and entirely distinct from *Andropogon muricatus*. The specimen is still in Linnæus' herbarium and was correctly identified by R. Brown[1] with his *Panicum abortivum*, that is *Chamæraphis spinescens*, a characteristic floating grass of the Indo-Malayan region. Retzius[2] himself is responsible for the erroneous reduction of *Andropogon squarrosus* to *Andropogon muricatus*, which recently has been revived, although Roxburgh[3] long ago drew attention to the confusion. "*Zizanioides*" being the earliest specific epithet, it will have to be adopted for the "Khas Khas," so that its name under *Veliveria* must be *V. zizanioides*.'

Vern. Names : Vala, Ushir, Valo, Bala, Khas Khas of the Anglo-Indians.

Description : A densely tufted perennial grass. Rootstock branching with spongy aromatic roots. Culms stout, up to over 1·8 m. high, usually sheathed all along. Leaf-sheaths compressed, especially the lower which are sharply keeled and fan-like, imbricate, very smooth, firm ; ligules reduced to a scarious rim ; blades narrowly linear, acute, 30-90 cm. long, 4·2-10·6 mm. wide, erect, rigid, firm or somewhat spongy, usually glabrous, rarely more or less hairy downwards on the face, pale green, midrib slender, lateral nerves close, 6 or more on each side, rather stout, slightly prominent, margin spinously rough. Panicle oblong, up to over 30 cm. long, usually contracted ; rhachis stout, smooth ; whorls 6-10 with up to 20 rays ; branches oblique to suberect, naked for up to 5 cm., filiform, slightly rough. Racemes up to 5 (rarely 7·5) cm. long, very slender ; joints about as long as the sessile spikelets or sometimes distinctly exceeding them, smooth or more or less rough, minutely and unequally ciliolate at the slightly oblique tips ; pedicels similar, but shorter. Sessile spikelet linear-lanceolate to almost linear, acute or subacute, 4·2-4·8 mm. long, yellowish, olive or violet-brown or purplish to almost black ; callus obtuse, under 1 mm. long, glabrous. Involucral glumes, acute, coriaceous, lower muriculate all over the back, 5-nerved, lateral nerves close, very fine ; upper spinulously muricate on the keel. Lower floral glume as long as the involucral glumes, acute, reversedly ciliolate, upper up to 3·3 mm. long, narrow, oblong-lanceolate, mucronulate, ciliate. Lodicules 2, quadrate and conspicuous, though small. Styles and stigmas short. Stigmas purple. Anthers 2-3·3 mm. long. Pedicelled spikelet sparingly aculeolate or almost smooth ; upper floral glume entire, acute.

Locality : Gujarat : Road to Lasandra (Chibber !) ; Daman (Bhide !) ; Ahmedabad, common in damp valleys (Sedgwick !).—*Konkan* : Ghatkoper, Horse-shoe Valley (McCann 9957 !).—*N. Kanara* : Dandeli (Talbot 2209 !).

Cke. l.c. classes this species amongst non-indigenous plants. We are of opinion that it is indigenous in most parts of the Presidency.

Distribution : Practically over the whole of India, and eastwards to Burma. Occasionally cultivated. Lower Guinea in Tropical Africa. Throughout the Malayan region only cultivated or as an escape. Introduced into the Mascarenes, the West Indies and Brazil.

Early history and economic uses : See Stapf in Kew Bull., l.c.

29. CHRYSOPOGON, Trin. Fund. Agrost. 187 ; Stapf in Fl. Trop. Afr., ix, 159.

Perennial (at least in the Old World). Leaf-blades narrow. Panicles usually lax, of whorls of simple or basally divided filiform branches, rarely the branches 2-nate or solitary. Spikelets in threes at the ends of the branchlets of terminal panicles, one sessile, the other 2 pedicelled, the three falling entire from the thickened, nearly always bearded, oblique tips of the peduncles ; exceptionally 2-nate in 2-jointed racemes, one sessile, the other pedicelled, each sessile spikelet falling with the contiguous joint and its pedicelled companion, pedicels and joints, if present linear-filiform, never longitudinally grooved or appendaged. Florets 2, lower reduced to an empty glume, upper hermaphrodite in the sessile, male or neuter in the pedicelled spikelet. Sessile spikelets usually laterally compressed, awned. Involucral glumes subequal ; lower coriaceous or chartaceous, involute with a rounded back or complicate and more or less keeled upwards, upper boat-shaped, more or less keeled. Floral glumes hyaline, lower 2-nerved, upper linear, entire or 2-dentate with a usually perfect awn from the sinus. Pale 0 or small, hyaline, nerveless. Lodicules 2, small, glabrous. Stamens 3. Stigmas exserted laterally low down. Grain linear, laterally compressed ; embryo half the length of the grain ; scutellum linear-oblong. Pedicelled spikelet dorsally compressed, awnless or aristulate.

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[1] R. Brown Prodr. Fl. Nov. Holl. (1810), 193.
[2] Retz., l. c., v (1789), 21.
[3] Roxburgh Fl. Ind. ed., Carey and Wall. I (1820), 270.

Species about 18 in the hot parts of the Old World, only a few entering the temperate zone. One in Florida and Cuba.

Cooke (ii, 984–986) describes 4 species of *Andropogon* belonging to the section *Chrysopogon* : *A. aciculatus*, Retz., *A. lancearius*, Hook. f., *A. monticola*, Schult., and *A. Aucheri*, Boiss.

To these we add 4 species not noted from the Presidency before : *Chrysopogon Wightianus*, Ness, *Ch. asper*, Heyne, *Ch. polyphyllus*, Blatter and McCann, and *Ch. Gryllus*, Trin.

A. Pedicels of the upper spikelets half as long as the sessile spikelets or longer
  I. Pedicels of upper spikelets glabrous or nearly so
    1. Stems erect. Leaves 15–45 cm. long ... 1. *C. Gryllus.*
    2. Stems creeping below. Leaves 2–13 cm. long ... ... 2. *C. aciculatus.*
  II. Pedicels of upper spikelets villous with rusty rarely pale hairs
    1. Lower involucral glume of pedicelled spikelets long-awned, upper not or very shortly awned
      (*a*) Callus long villous all round ... 3. *C. asper.*
      (*b*) Callus glabrous in front ... ... 4. *C. lancearius.*
    2. Involucral glumes of pedicelled spikelets both awned ... ... 5. *C. Wightianus.*
B. Pedicel of upper spikelets not half as long as the sessile spikelets
  I. Lower sheaths compressed ... ... 6. *C. montanus.*
  II. Lower sheaths terete
    1. Leaves, peduncle and branches of panicle glabrous .. .. 7. *C. polyphyllus.*
    2. Leaves, peduncle and branches of panicle not glabrous ... ... 8. *C. Aucheri.*

1. **Chrysopogon Gryllus,** Trin. Fund. Agrost. 188 ; Nees Gen. Fl. Germ. Monocot. i, t. 93 ; Benth. Fl. Austral. vii, 537.—*Andropogon Gryllus*, Linn. Cent. Pl. ii, 33 ; Hack. Monogr. Androp. 550 ; Host. Gram. Austr. ii, 1, t. 1 ; Sibth. Fl. Græc. i. t. 67 ; Duthie Grass. N. W. Ind. 22, Fodd. Grass. N. Ind. 40 ; Hook. f. in F. B. I. vii, 187 ; Collett Fl. Siml. 602, fig. 191.—*A. echinulatus, glabratus et Royleanus*, Steud, Syn. Gram. 395, 397.—*Chrysopogon glabratus*, Trin. in Mem. Acad. Petersb. ser. 6, ii (1833), 318.—*Rhaphis Gryllus*, Desv. Opusc. 69.—*R. echinulata*, Nees in Royle Ill. Bot. Himal. 417.—*Pollinia Gryllus*, Spreng. Pugill. ii, 10 ; Reichb. Ic. Fl. Germ. t. 54.—*Apluda Gryllus*, Presl. Cyp. & Gram. Sic. 55.—*Holcus gryllus et pallidus*, Br. Prodr. 199.

Description : Stems simple, forming dense hard tufts, erect, 15 cm. to 1·5 m. high ; nodes smooth. Leaves 15–45 by 4–8 mm., linear, acute, glabrous or hirsute, margins serrulate ; sheath keeled above, glabrous or pubescent. Panicle large, 12–20 cm., rhachis angular, scabrid, axils bearded, branches long, 5–10 cm., capillary, spreading, simple or branched, usually very many in a whorl and bearing 2–4 spikes, tips obliquely truncate and densely bearded. Sessile spikelets 5-8 mm., callus straight, acute. Lower involucral glume coriaceous, 2-toothed, dorsally rounded with 2 muricate or mamillate keels or channels, shining, smooth or scaberulous, margins broadly involute, upper chartaceous, hyaline, lanceolate, mucronate or aristulate, awn equalling the spikelet or shorter, keel and sides bristly above the middle. Lower floral glume linear-oblong, obtuse, nerveless, upper linear, minutely 2-toothed, awn minute or 12–35 mm. long. Pale small, oblong, glabrous. Pedicelled spikelets rather longer than the sessile, terete, lanceolate, acuminate ; pedicels glabrous or ciliolate. Lower involucral glume acuminate or aristulate, 5–9-nerved keels ciliate above, upper lanceolate, acuminate, ciliate. Floral glumes narrower, ciliate, awn of upper half the size of the glume.

Locality : N. Kanara : Halyal (Talbot 2088 !).

Distribution : Temperate Himalaya from Kashmir to Sikkim, 4,000-9,000 ft. Khasia Hills, 4,000-5,000 ft., westwards to N. Africa and S. Europe, Australia.

2. **Chrysopogon aciculatus**, Trin. Fund. Agrost. 188 ; Duthie Grass. N. W. Ind. 22 (*acicularis*), Fodd. Grass. N. Ind. 39 ; Benth. Fl. Hongk. 424, Fl. Austral. vii, 538.—*Andropogon aciculatus*, Retz. Obs. v (1789), 22 ; Roxb. Fl. Ind. i, 262 ; Grah. 238 ; Hack. Monogr. Androp. 562 ; Hook. f. in F. B. I. vii, 188 ; Cke. ii, 984.—*A. acicularis*, Willd. Sp. pl. iv, 906.—*Rhaphis acicularis*, Desv. Opusc. 69.—*R. trivalvis*, Lour. Fl. Cochinch. 553 ; Trin. Sp. Gram. Ic. t. 8, 9.—*Centrophorum chinense*, Trin. Fund. Agrost. 106, t. 5.— Rheede Hort. Mal. xii, t. 43.

Description : Cke. l. c.

Locality : Konkan : Alibag, sandy shore (Ezekiel !).—*N. Kanara :* Karwar, sea-shore (Sedgwick and Bell 5070 !) ; Jog, hills (Hallberg and McCann A272 !).

Distribution : More or less throughout India, Ceylon, Tropical Asia, Australia, Polynesia.

Uses : According to Haines the leaves which lie close to the ground escape to a large extent the lips of cattle. The plant is a pest on account of the sharp callus and small awns sticking to the clothes.

3. **Chrysopogon asper**, Heyne ex Wall. Cat. n. 8784.—*Andropogon asper*, Heyne in Herb. Rottler ex Hook. f. in F.B.I. vii, 189.

Description : Stem 30–90 cm., leafy below, very slender above. Leaves distichous, 30–45 cm. by 12–18 mm., broadly linear, acute cordate, coriaceous, flat, smooth, 11-nerved, midrib very slender, spinulose beneath, margins spinulosely serrulate, and with a few long tubercle-based cilia towards the broad semi-amplexicaul base ; sheaths broad, compressed, laxly hirsute, lower ones 12 mm. broad, keeled, armed with scattered tubercle-based hairs. Panicle 18 cm. long, narrow, of many whorls of short, unequal, simple, smooth, erect branches bearing solitary rarely 2 erect spikes, tips very shortly bearded. Sessile spikelets 6 mm. long, pale, coriaceous, callus up to 2 mm., long villous all round. Lower involucral glume hispid beneath, the tip strongly compressed above ; upper with the keel and sides more or less hispid above the middle, awn as long as the glume or shorter. Lower floral glume shorter than the upper involucral, narrow, obtuse, 2-nerved, ciliate, upper consisting of the linear, hyaline, 3-nerved base of the awn, awn 35–50 mm. long. Pedicelled spikelets 8 mm. long, narrowly lanceolate, 7-nerved, pale, shining, keels ciliate ; pedicels very shortly rufous-villous on both margins, excised at the tip in a semi-circle ; lower involucral glume thin, tip 2-dentate, nerves strong, sub-equidistant, or the 3 lateral on each side submarginal, margins narrowly incurved, keels ciliolate from base to tip, upper lanceolate, acuminate, 3-nerved, ciliolate. Lower floral glume linear-oblong, 2-nerved, ciliate, upper narrowly lanceolate, 1-nerved.

Locality : N. Kanara : Tinai (Talbot 2564 !).

Distribution : Madras : Pulicat Hills.

4. **Chrysopogon lancearius** Haines in Haines Bot. Bihar and Orissa 1036.—*Andropogon lancearius*, Hook. f. in F. B. I. vii, 190 ; Cke ii, 985.

Description . Cke. l. c.

Locality : Deccan : Panchgani (Blatter and Hallberg B 1230;).—*S. M. Country*: Castle Rock (Woodrow). Seems to be very rare in the Presidency.

Distribution : Sikkim Himalaya, Behar, Chota Nagpur, Orissa, W. Peninsula.

Uses : A good fodder according to Haines.

5. **Chrysopogon Wightianus**, Nees ex Steud. Syn. Gram. 397.—*Andropogon Wightianus*, Steud. Syn. Gram. 395 ; Hook. f. in F. B. I. vii, 191.—*A. aristulatus*, Hochst. ex Steud. Syn. Gram. 397 ; Hack. in Monogr. Androp. 556.—*A. breviaristatus*, Steud. l. c. 396.—*Rhaphis orientalis*, Desv. Opusc. 69.—*R. Wightianus*, Nees ex Steud. l. c.

Description : Very variable in habit. Stems short or long, erect or ascending from a short stout creeping stock. Leaves 7–25 cm. long, linear, acute, rigid, from glabrous to pubescent on both surfaces and with sometimes tubercle-based hairs, spinulosely serrulate ; sheaths glabrous, lower ones compressed ; ligule very short, villous. Panicle 7-13 cm. long, contracted, lower branches long, few in a whorl, rhachis and branches minutely hairy ; spikes solitary, green or brownish. Sessile spikelets subcylindric, 4 mm. long, callus long, densely bearded with rusty hairs all round. Lower involucral glume laterally compressed above, minutely truncate, glabrous below, hispid above, obscurely 4-nerved, tip 2-dentate, upper chartaceous, hispid above on the keel and sides, tip 2-lobed, awn as long as the glume or shorter. Lower floral glume linear-oblong, 2-nerved, ciliate, upper consisting of an awn with a narrowly dilated 2-lobed base, awn 50-65 mm. long, column hispid. Pedicelled spikelets nearly 12 mm. long, lanceolate, pubescent ; pedicel truncate, margins shortly villous. Lower involucral glume glabrous or pubescent, 7-nerved, awn longer than the glume, keels ciliate, upper lanceolate, 3-nerved, awn as long as the glume or shorter. Lower floral glume oblong, 2-nerved, ciliate, upper very narrow, ciliate, nerveless.

Locality : S. M. Country : Castle Rock (Bhide!). — *N. Kanara :* Jog to Sidderpur, open grass land (McCann A273!).

Distribution : Madras, Nilgiris, Burma, Assam. (Hackel mentions a specimen gathered in Ceylon but, according to Hooker f., it seems to be a starved specimen of *Chrysopogon zeylanicus*, Thw.).

6. **Chrysopogon montanus**, Trin. in Spreng. Neue Entdeck. ii, 93; Haines Bot. Bihar and Orissa 1037.—*Andropogon monticola*, Schult. Mant. (1824), 665 ; Kunth Enum. Pl. i, 506 ; Steud. Syn. Gram. 395 ; Hack. Monogr. Androp. 557 (excl. var. *velutinus*); Hook f. in F. B. I. vii, 192, *cum omnibus var.*; Cke. ii, 985 ; Hole in Ind. Forest Mem. i (1911), 108.—*A. Sprengelii*, Kunth Rev. Gram. 166.—*Pollinia fulva*, Spreng. Pugill. ii, 93—*Andropogon Trinii*, Steud. Syn. Gram 395 ; Hack. Monogr. Androp. 558. -- *A ciliolatus cœruleus et increscens*, Steud. l. c.—*Chrysopogon ciliolatus*, Boiss, Fl. Or. v. 458 (excl. var. *Aucheri*, Boiss); Duthie Grass. N. W. Ind. 22.—*C. cœruleus*, Duthie l. c. 23, Fold. Grass. N. Ind. 39, t. 60.—*C. increscens*, Nees ex Steud. l. c. 396.—*C. Wightianus* var. *leucanthus*, Thw. Enum. Pl. Zeyl. 366.—*C. serrulatus*, Trin. in Mem. Ac. Petersb. ser. 6, ii (1833), 318, Spec. Gram. t. 331.— *C. Esenbeckii*, Arn. in Steud. Syn. 395.—*Raphis ciliolata et cœrulea*, Nees ex Steud. Syn.396, 395.

This synonymy requires an explanation. *Chrysopogon montanus*, Trin. as understood in this place comprises Hackel's two species *Andropogon monticola* Schult. and *A. Trinii*, Steud., and is identical with Hook. f.'s. *A. monticola*, Schult. with all its varieties.

Hackel has two species and he distinguishes them by the following characters :

A. monticola : Upper involucral glume of sessile spikelet keeled, the keel from the base up to ⅔-¾ of its length densely pectinate ciliate with long, rigid, rufous hairs, shortly white hispid in the upper ¼.

A. Trinii : Upper involucral glume of sessile spikelet keeled below the apex only, keel white-ciliate, the lower ⅔-¾ not keeled and glabrous.

Hook. f. in F. B. I. makes of these species two varieties : var *monticola* proper and var. *Trinii*, and includes them under *A. monticola*, Schult., adding a third variety : var. *robustus*.

At the same time Hooker confesses: ' I am unable to classify the varieties of this common and variable plant in accordance with geographical areas or other considerations. This, if possible, must be effected by field-botanists in India. There is every gradation from the coarsely hirsute keel of *monticola*, to the perfectly smooth of some states of *Trinii*; from the awnless to long awned gl. I of the pedicelled spikelets, and from the glabrous to the pubescent of the same organ ; the colour of which affords no character ; nor does its length, or that of the cilia on its keels. '

Cooke (ii, 985) has adopted the name *A. monticola*, Schult. with Hooker's description and evidently also the latter's varieties. But his opinion does not count in this case as he has not seen any specimens from the Presidency and ' was therefore ' as he says himself, ' unable to fix definitely the variety to which the Bombay species belong. They will probably belong to var. *Trinii* H. f.' What induced Cooke to say that they probably belong to var. *Trinii* we cannot understand, especially as Hooker came to the conclusion that he was not able to classify the varieties according to geographical areas.

We have examined a great number of specimens from all parts of the Presidency, except Sind, Cutch and Kathiawar and we have been able to separate many into the two varieties. They exhibit almost the same distribution and often both are found in the same locality, with this exception that var. *Trinii* has not been observed in N. Kanara, Gujarat and the Konkan. But we must also mention, and this is the most important point, that we saw many specimens all over the country which could not be classed under either variety, and it would require many new varieties if we wanted to give a name to all the different variations. And even then they would be forms only and not varieties.

Haines seems to have felt the same difficulty when he tried to classify the *montanus* material of Bihar and Orissa. He distinguishes five forms. If we wanted to follow the same method for our area, we doubt whether double the number of forms would yield satisfactory results.

Stapf describes the specimens from Tropical Africa under the name of *C. montanus* var. *tremulus*, Stapf. He calls it ' one of the several races which constitute the rather polymorphic species *C. montanus*, Trin., whose area includes Southern Africa, Madagascar and India. The var. *tremulus* approaches very closely the var. *elatior*, Stapf, a large-spikeleted parallel to the var. *serrulatus*, Stapf (*Chrysopogon serrulatus*, Trin.) and differs from it apparently only in the almost quite smooth rhachis and branchlets (a few sharp-pointed hairs may be found under a high power) and the pedicels, which are glabrous almost up to the middle, and not ciliate from the base. ' It seems to us (it may look like presumption on our part to criticize our veteran and highly merited agrostologist) that it is somewhat risky to found new varieties of a protean species on a few specimens only.

According to Hole all the 3 varieties mentioned by Hooker ' appear to vary greatly, as regards their habit and vigour of growth, in response to the moisture conditions of the habitat and also according as whether, or not, the plants are habitually grazed, cut for fodder, or periodically burnt. The colour of the cilia of glume II of the sessile spikelet (pale or white in *robustus* and rufous in *monticola*), accordingly, appears to be the chief difference in the habit, and these forms appear to have different and fairly defined areas of distribution (*monticola* occurring chiefly in Central and Southern India, while *robustus* is mainly found in N. India, in the outer N. W. Himalayas and Sub-Himalayan tract). ' Hole who studied the varieties *robustus* and *Trinii* both from herbarium specimens and in the field has observed that the plant at Dehra Dun gradually and imperceptibly passes from the typical *robustus* to the typical *Trinii*. We are justified in stating that a similar transition takes place between *monticola* and *Trinii* in Western India. (Of Central and Southern India we have no experience). We have therefore a gradual transition from *robustus* to *Trinii* at Dehra Dun, and from *Trinii* to *monticola* in W. India and consequently, we are not allowed to consider Hooker's varieties as good varieties.

Vern. Names : Sunthia Khad (Dohad), Agiva, Gogar, Ghora, Dand, Pandhari Kusal (Poona), Kare Hullu (Bijapur).

Description : A very variable perennial grass. Stems usually slender, erect or geniculately ascending, glabrous, sometimes robust, simple or branched, 30 cm. to 1·2 m., but often attaining 2 m., slightly compressed, solid, developing usually axillary leafy and flowering branches from all the upper nodes except the one next below the panicle. (The branches growing within the sheaths push the latter away from the stem which often results in a characteristic fan-shaped appearance.) Blade of uppermost leaf of flowering stem usually mucroniform, but attaining 8 cm., of lower leaves up to 43 cm. long and 8 mm. broad, linear acuminate, tapering from the base, scabrid on margins, sometimes also scabrid dorsally on midrib, and scaberulous above, especially towards the apex, often ciliate towards the base with tubercle-based hairs, at least when young ; sheath glabrous, compressed, keeled, especially of the lower leaves, shorter or longer than the proper internode ; ligule a minute membranous rim. Panicle 5-15 cm. long, ovate to subcylindric, yellowish to purplish, of several whorls of few or many capillary flexuous very unequal branches bearing solitary spikes, branches of flowering panicle more or less horizontally spreading, of the fruiting panicle erect and closely appressed to the rhachis, rhachis and branches smooth or scaberulous. Spikelets in clusters of 3, a central sessile hermaphrodite one with 2 lateral pedicelled male ones, the clusters being terminal and solitary on the capillary branches of the panicle. Sessile spikelets laterally compressed, 4-7 mm. long, tip of peduncle brown-bearded, clavate, callus short, with oval scar and dense beard. Lower involucral glume laterally compressed, narrow-oblong, embracing the margins of the upper, chartaceous 2–4-nerved, hispidly ciliate dorsally on keel towards the apex or almost glabrous, often scaberulous dorsally on nerves and minutely pubescent with appressed hairs dorsally near margin, apex subtruncate or 2-dentate. Upper involucral glume laterally compressed, broader than lower, obtusely keeled, subcoriaceous, 3-nerved, margins broad, hyaline, membranous, ciliate or not, very variable with regard to its hairiness, sometimes almost glabrous, at other times hispidly ciliate dorsally on keel with long white or rufous hairs more or less from base to apex, sometimes also pubescent, or minutely villous dorsally on keel and lateral nerves, awned, awn 2·5–6 mm. long, apex entire or 2-lobed. Lower floral glume ½ the length of to subequal the upper involucral glume, linear, hyaline, ciliate, nerveless or indistinctly 1–3- or more-nerved, apex obtuse. Upper floral glume consisting of the narrow 3-nerved base of the awn, basal ½ or ⅔ hyaline, membranous, upper portion chartaceous, awn geniculate, 10–18 mm. long, but also reaching 37 mm. (including the twisted column), margins ciliate or not, apex entire or 2-lobed. Pale sometimes present, very narrow, 1·25 mm. long. Lodicules 2, cuneate, glabrous. Anthers 3, up to 3 mm. long, yellow or purple. Stigmas 2, laterally exserted at base of spikelet, yellow. Pedicelled spikelet dorsally compressed, subequal the sessile spikelet; pedicel less than half the sessile spikelet, usually about ⅓ the spikelet, densely ciliate on both margins with stiff rufous or white hairs, the upper of which are shorter than to subequal the spikelet. Lower involucral glume lanceolate, membranous, 5–7-nerved, minutely pubescent with appressed hairs dorsally, especially towards the apex, or almost glabrous, sometimes ciliate dorsally on midrib and marginal nerves, especially towards the apex acute or shortly awned. Upper involucral glume subequal to the lower, 3-nerved, margins incurved, long ciliate, apex acute or mucronate, glabrous dorsally. Floral glumes linear, hyaline, ciliate, nerveless or indistinctly nerved. Pale sometimes present, as in sessile spikelet, but slightly longer, very narrow.

The flowers are much visited by small bees.

Locality : Gujarat : Mahal-Dangs, elevation 800 ft., rainfall 100″ (Sedgwick and Bell 5391 !) —*Khandesh:* Tapti River (Blatter and Hallberg 5476!); Bhusawal (McCann 5224 A !) ; Nandgaum, Bori River (Blatter and Hallberg 3827 !) ; Bori, Tapti Island (Blatter and Hallberg 5146 !) ; Amalner, Bori River (Blatter and Hallberg 4455 !).—*Konkan :* Sion Creek (Sabnis A 231 !) ; Matheran (D'Almeida 9958 !).—*Deccan :* Khandala to Karjat (Blatter and Hallberg A 232 !) ; Kirkee (Talbot !) ; Pashan (Gammie !) ; Mangiri, 8 miles E. of Poona (Gammie !) ; Katraj (Gammie !) ; Pasarni Ghat (Blatter and Hallberg B 1209 !).—*S. M. Country :* Dumbai (Talbot 2317 !) ; Badami (Talbot 2926 !) ; N. W of Dharwar (Sedgwick 3141 !); Dharwar, dry pasture land, elevation 2 400 ft., rainfall 34″ (Sedgwick 1817 !) ; Konankeri, elevation 1,800 ft., rainfall 35″ (Sedgwick and Bell 4439 !) ; Haveri (Talbot 2189 !).—*Kanara :* Jog to Siddhapur, open grass land (Hallberg and McCann A274 !). This species forms patches of many individuals, or combines with other individuals to form associations of a few species.

Distribution : Throughout India, especially in hilly tracts, from the N.W. Himalaya southwards, ascending to 6,000 ft., extends to Ceylon, Burma, Afghanistan, Tropical and S. Africa, Madgascar.

Uses : In Bihar and Orissa this grass is considered to be a valuable fodder, and Hole, writing of the Siwalik Division, calls it one of the most valuable fodder grasses. In Mount Abu, according to Lisboa, it is reckoned as a good fodder grass and the grain is used as food by the natives. But the same writer, under the name of *Andropogon serrulatus*, Trin. (= *Chrysopogon montanus* var. *Trinii*) remarks : 'Said to be good fodder, used much in Poona, but reports from other places unfavourable.' (J. C. Lisboa, List of Bombay Grasses, Bombay (1896), 81).

The last statement might find an explanation by a suggestive note made by Hole (l. c. 111) : 'So far as the local (Dehra Dun) plant is concerned specimens with the more hairy glume II tend to occur in localities where there is a scarcity of available moisture, both on the dry ridges and slopes of the Siwalik Hills and also (rarely) on water-logged soil, and the writer believes that the characters which have been utilized to define these varieties vary in response to the factors of the habitat and particularly in response to the available water supply. Provided that the development of the plants has not been interfered with by grazing, grass-cutting, or other agency, those plants with the more hairy glume II are usually less robust and less coarse, or rank, than the others, and they are therefore as a rule most valued for fodder and are distinguished locally by the vernacular name of *dhaula*, whereas the coarser plants with smooth glume are called *gurla*. As this grass affords a valuable fodder and is sometimes cultivated, in consequence, it is important to determine the extent to which its characteristics are constant. If, as suggested above, they depend on the available moisture, it is obvious that cultivation of this grass on good agricultural land, with a large quantity of available moisture, would result in producing an inferior class of rank, coarse fodder.'

7. **Chrysopogon polyphyllus**, Blatter & McCann, *comb. nov.—Andropogon polyphyllus*, Hook. f. in F. B. I. vii, 194 (*qui habet* Hack. mss. in Herb. Duthie).—*A. Aucheri*, var. *polyphyllus*, Hack. in Herb. Duthie.

Description : Stem 60–90 cm. high, as thick as a crow-quill or more, stiff, simple or fastigiately branched, quite glabrous. Leaves crowded or not, 15–25 cm. by 2–4 mm., narrow, rigid, acuminate, flat, pale glaucous-green, glabrous on both surfaces, coriaceous, midrib and nerves very slender, margins minutely scaberulous ; sheaths terete, appressed, hard. Panicle 10–13 cm. long, oblong, subsecund, dense-flowered, very pale, branches 6–12 mm., very unequal, in many closely approximate whorls, smooth, peduncle slender, quite glabrous. Sessile spikelets 4 mm. long drooping, white or pale purplish, callus long, $1\frac{1}{2}$ mm. long, obtuse, bearded at the very base only with long fulvous hairs. Glumes as in *C. montanus*. Lower involucral glume obtuse, glabrous, keel ciliate towards the tip ; upper not awned, keel glabrous or ciliate. Upper floral glume with an awn 3–8 mm. long, nearly straight, pale. Pedicelled spikelets narrowly lanceolate, acuminate, glabrous, 7-nerved, eciliate, not awned, rather longer than the sessile ; pedicels naked, villous at the tip only.

Can easily be distinguished from *C. montanus* by the stout naked callus which is bearded at the base only, and by the naked pedicels which are long-villous only at the tip.

It differs from the next species, *C. Aucheri* by its size, the long, glabrous, glaucous leaves and the glabrous peduncle and branches of the panicle.

Locality : Gujarat : Porbandar (Bhide !) ; Dohad (Bhide !) ; Watrak River on rocks (Sedgwick 1165 !) ; Daman (Bhide).—*Deccan :* Dhond, river-bank (Bhide !).

Distribution : Central Provinces. W. Peninsula.

8. **Chrysopogon Aucheri**, Stapf in Kew Bull. (1907), 211.—*Andropogon Aucheri*, Boiss. Diag. ser. 1, fasc. 5 (1844), 77 ; Hook. f. in F.B.I. vii, 195; Cke. ii, 986.–*A. Aucheri*, var. *genuinus*, Hack. Monogr. Androp. 560.—*Chrysopogon ciliolatus*, var. *Aucheri*, Boiss. Fl. Or. v, 458.

Description : Cke. l. c.

Stapf thinks that *C. Aucheri* comprises several geographical races and that the one from which the species was first described extends from Arabia through Southern Persia and Baluchistan to Sind. He characterizes it ' by the lower glume of the pedicelled spikelet being usually awnless or in any case much more shortly awned than the upper, by the glume awns not being ciliate or ciliate only at the base, and by the longer beards of the pedicels.'

Locality : Sind : Gizri (Sabnis B777 !) ; Jemadar ka Landa near Karachi (Stocks).

Distribution : Sind, Baluchistan, Afghanistan, S. Persia, Arabia (not Africa).

30. ARTHRAXON Beauv. Agrost. 111 ; Cke. ii, 967.

Species about 20, in the tropical and subtropical regions of the Old World.

We retain the 6 species mentioned by Cke. l.c. His *A. lanceolatus*, Hochst. will be slightly restricted under the name of *A. serrulatus*, Hochst., the name *A. lancifolius*, Hochst, will be substituted for *A. microphillus*, Hochst., and *A. quartinianus*, Nash, will take the place of *A. ciliaris*, Beauv.

Key as in Cke.

1. **Arthraxon inermis**, Hook. f. in F. B. I. vii, 145 ; Cke. ii, 968.

Description : Cke. l.c.

Locality : Konkan : Okda Forest, Thana District (Ryan 718 !); Wada Range, Thana District (Ryan 692 !) ; Matheran (Woodrow !); Marmagoa (McCann !). —*Deccan* : Mahableshwar (Sedgwick and Bell 4513 !, Woodrow) ; Purandhar

(McCann 5592 !); Khandala (McCann 9950 !, 9740 !).—*S. M. Country:* Derikop woods (Sedgwick 1845 !); Castle Rock (Gammie 15678 !).

Distribution: W. Peninsula, apparently endemic.

2. **Arthraxon serrulatus,** Hochst. in Flora (1856), 188; Stapf in Fl. Trop. Afr. ix, 163 —*A. lanceolatus*, Hack. in Monogr. Androp. 348 (excl. var. *echinatus*); Duthie, Grass. N. W. Ind. 17; Hook.f. in F.B.I. vii, 143 (*partim excl. Batratherum echinatum*, Nees in Edinb. Phil. Journ. xviii, (1835) 181; *Andropogon echinatus*, Heyne ex Steud. Nomencl. ed. 2, 91; *Arthraxon echinatus*, Hochst. in Flora (1856), 188; *Andropogon lanceolatus*, Roxb. Fl. Ind. i, 257); Cke. ii, 968 (*partim*). *A. lanceolatus* var *genuinus*, subvar. *serrulatus*, Schweinf. in Bull. Herb. Boiss., 2. ser. ii, 10.—*Andropogon serrulatus*, Link Hort. Berol. i, 241 (*quoad specimen, descriptio partim erronea* ?); A. Rich. Tent. Fl. Abyss. ii, 458.—*A prionodes*, Steud. Syn. Pl. Glum. I, 383.—*Batratherum lanceolatum*, Nees in Edinb. New Phil. Journ. xviii (1835), 181.—*B. serrulatum*, Hochst., ex Steud. l.c.

This species includes all the material of the Nileland of Tropical Africa, of tropical Arabia and the greater part of the Indian specimens which, up to now, were ranged under *Arthraxon lanceolatus*, Hochst., as understood by most authors.

It has been pointed out by Stapf that *Arthraxon lanceolatus*, Hochst., was founded on *Andropogon lanceolatus*, Roxb., a Coromandel plant, which has larger and wider long-awned spikelets with the lower involucral glume very minutely muricate towards the tips only. Neither of these names can, consequently, be mentioned as synonyms of *Arthraxon serrulatus*.

Description.—A perennial grass; rhizome short, emitting fascicles of closely set culms and innovation shoots, which are more or less thickened below and covered with reddish silky cataphylls. Stems rather slender, up to 90 cm. high, many-noded, usually finely pubescent, sometimes glabrous, with vegetative branches below and usually solitary flowering branches above, the latter subfastigiate. Leaf-blades lanceolate to ovate-lanceolate, setaceously acuminate, with a caudate amplexicaul base, glaucous or greenish, 2·5–5 cm. long, 12–18 mm. wide, margins cartilaginous, ciliate with the cilia springing from tubercles, smooth, very finely pubescent below or glabrous, primary lateral nerves about 8–11 on each side, fine, slightly raised below; ligule 1–2 mm. long, rounded, membranous; sheaths terete, tight, slightly shorter than the internodes or exceeding them in the leafy shoots, more or less hairy with tubercle-based hairs and often softly pubescent at the nodes, the uppermost frequently glabrous. Racemes 2–5 nate, slender, greenish or suffused with purple or violet, 3-over 5 cm. long on a short common axis, the fascicles borne on a slender peduncle, shortly or far exerted from the supporting bladeless or almost bladeless sheath; rhachis fragile shortly bearded at the nodes; joints narrowly linear, 3·3–6·3 mm. long, hairy on the back and sides, or the lowest almost glabrous, hairs increasing upwards to more than 2 mm.; pedicels very similar, but much shorter and more slender. Sessile spikelets narrowly lanceolate-linear to linear slightly tapering upwards up to 7·4 mm. long (not including the awn), glabrous; callus very short, puberulous. Glumes 4. Lower involucral glume chartaceous, 6 mm. long, lanceolate, with a minutely truncate hyaline tip, very convex on the back, which is smooth or more often muricate along the 4 indistinct or faintly raised inner, spinulously muricate along the outer nerves, margins hyaline, comparatively wide; upper linear-lanceolate in profile, membranous, 3-nerved, glabrous or nearly so. Lower floral glume linear, acute, up to 4 mm. long, hyaline, nerveless or obscurely 1-nerved at the base; upper membranous at the base, hyaline upwards, narrowly lanceolate-linear in profile, 2-dentate, with the teeth minute, sometimes produced into short capillary bristles, delicately 3-nerved, awned from near the base, awn 8–15 mm. long, very fine, kneed about the middle, twisted below. Anthers up to 3 mm. long. Grain bacilliform about 4·2 mm. long. Pedicelled spikelet male, linear-lanceolate, acute, about 5 mm. long. Involucral glumes subequal, lower herbaceous-chartaceous, acute, scaberulous along the outer and slightly so on the 4–5 inner nerves or almost smooth, upper slightly shorter, membranous, otherwise as in the sessile spikelet. Lower floral glume as in the sessile spikelet, upper linear-oblong, obtuse, nerveless, muticous.

Locality: Sind: (Stocks 642).—*Gujarat:* Morvi, Kathiawar (Woodrow).—*Deccan:* Lonavla (Woodrow); Pashan, tank (Gammie !). Panchgani (Blatter and Hallberg B1277!).—*S. M. Country :* S. W. of Dharwar (Sedgwick and Bell 4436!) ; Derikop (Sedwick 2022!) ; Belgaum, Fort wall (Sedwick 3013 !).

Distribution : More or less throughout India, Tropical Arabia and Tropical Africa (Nileland).

3. **Arthraxon Meeboldii,** Stapf in Cke. ii, 969, in Kew Bull. (1908), 449.

Locality : Western Ghats : Khandala, in open grassland on a hillside, 600 m. (Meebold 9132) ; Khandala, common (McCann 9949 !, 9948 !) ; Lonavla, common (Bhide !, McCann !); Panchgani (Blatter and Hallberg B1238 !, B1225 !), Tableland (Blatter 3804 ;); Mahableshwar (Sedgwick and Bell 4523). —*N. Kanara* : Tinai (Talbot 2569 !).

Distribution : W. Peninsula, apparently endemic.

4. **Arthraxon lancifolius,** Hochst. in Flora (1856), 188 ; Stapf in Fl. Trop. Afr. ix, 165.—*A. microphyllus*. Hochst. in Flora (1856), 188 ; Hack. Monogr. Androp. 351, *incl.* var. *lancifolius* ; Hook.f. in F.B.I. vii, 147 ; Cke. ii, 970 ; Haines Bot. Bihar and Orissa 1026.—*A. Schmidtii*, Hochst. (1856), 189.—*A. minor*, Hochst. l.c. 188, *partim.*—*A. Schimperi*, Hochst. l.c. *partim.*—*A. molle*, Balf. f. Bot. Socotra 315.—*A. ciliaris*, Henriq. in Bolet. Soc. Brot. xiii, 133, *non* Beauv.—*Andropogon lancifolius*, Trin. in Mem. Acad. Petersb. 6 ser., ii (1833), 271.—*A. molle*, Duthie Grass. N.W. Ind. 17.—*A. multicaulis*, Steud. Syn. Pl. Glum. i, 383.—*Batratherum molle*, Nees & Arn. in Edinb. New Phil. Journ., xviii (1835), 181 ; Aitchis. Cat. Panj. Pl. 174.—*B. Schimperi*, Nees ex Hochst. l.c. 179 —*Psilopogon Schimperi*, Hochst. ex A. Rich. Tent. Fl. Abyss. ii, 447.—*Pleuroplitis ciliata*, J. Schmidt Beitr. Fl. Cap. Verd. 152.—*P. Schimperi*, Regel in Bull. Acad. Petersb. x (1866), 369.—*Lucæa ciliata*, Steud. l.c. 414.

Description : Cke. l.c.

Locality : Gujarat : Surat (Herb. Dehra Dun !, Cooke !).—*Konkan :* Tungar hill, Thana District (Herb. Econ. Bot. Poona !); Parel (Herb. Econ. Bot, Poona !); Kurla (Garade !); Salsette (Jacquemont 713).—*Deccan :* Trimbak, Nasik District (Herb. S. X. C., Bombay !).—*S. M. Country :* Belgaum Fort walls (Sedgwick 3012 !); W. of Dharwar, banks of road, in forest (Sedgwick 1851 !); Castle Rock (Bhide !).—*Kanara :* Karwar (Talbot 1308 !) Yellapore (Talbot 2084 !).

Distribution : More or less throughout India, Ceylon to Tonkin and S. W. China, tropical Africa (Upper Guinea, Nileland).

5. **Arthraxon quartinianus,** Nash in North Americ. Fl. xvii (1912), 99, Merrill in Phillip, Journ. Sc. Bot. vii (1912), 229; Stapf in Fl. Trop. Afr. ix 166.—*A. major*, Hochst. in Flora (1856), 188.—*A. coloratus*, Hochst. l.c.—*A. plumbeus*, Hochst. l.c. 189.—*A. violaceus* Hochst. l.c.—*A. Schimperi*, Hochst. l.c. *partim.*—*A. ciliaris*, Rendle in Cat. Afr. Pl. Welw. ii, 138, *non* Beauv.—*A. ciliaris*, subsp. *quartinianus*, Hack. Monogr. Androp. (*excl.* vars. *Hookeri et glabrescens*).—*Alectoridia quartiniana*, A. Rich. Tent. Fl. Abyss. ii, 448, t. 99.—*Lucæa major*, Steud. Syn. Pl. Glum. i, 414 ; Hochst. l.c. 179 —*L. plumbea et violacea*, Steud. l.c.—*L. Schimperi*, Hochst. in Flora (1856), 180 (the genuine).—*Pleuroplitis plumbea*, Nees ex Steud. l.c.—*P. violacea*, Nees ex Steud. l.c.—*P. major*, Regel in Bull. Acad. Petersb. (1866), 369, *partim,*—*P. quartiniana*, Regel l.c. 376,*partim.*—*Andropogon violaceus*, Heyne ex Steud. l.c.—*A. Alectoridia*, Steud l.c. 383.

We wish to substitute *A. quartinianus*, Nash in place of *A. ciliaris*, Beauv. This latter species which was described in 1812 has been emended repeatedly since then, and that to such an extent that it is scarcely possible to recognize the original plant. Hackel made five subspecies : *Langsdorffii*, *submuticus*, *nudus*, *Quartinianus*, and *Vriesii*, and nine varieties. The subspecies were arranged by him in two leading groups :

1. Joints of rhachis glabrous, or with a few scattered hairs towards the tip (*Langsdorfii*, *submuticus*, *nudus*).
2. Joints of rhachis, at least the upper, more or less ciliate (*Quartinianus*, *Vriesii*).—To these two groups Hooker f. added a third one (F.B.I., vii, 146):
3. Spikes silkily villous, spikelets 5-7 mm. long, lower involucral glume entire or minutely 2 toothed, awn 12 mm. or more. (This is *Arthraxon cuspidatus*, Hochst., considered by Hackel as a distinct species.

Arthraxon quartinianus, Nash, and adopted by Stapf l. c., covers part of the subspecies *Quartinianus* in Hackel's group 2, including var. *Quartinianus* *s. str.* and var. *coloratus*, but excluding var. *Hookeri* and var. *glabrescens*. Quartin's specimen No. 14, collected in Abyssinia, and representing a form with large spikelets, has, according to Stapf, to be considered as the basis of the species, whilst Schimper's 1532, the type of *Arthraxon coloratus*, stands for the other extreme.

Arthroxan quartinianus, Nash, includes all the material of the Bombay Presidency that has come under our observation.

The rest of *A. ciliaris*, Beauv. *et auctorum* has to be studied separately, but as the material lies outside the Presidency we leave it to other botanists to work out their respective material.

Description : Annual. Stems very slender, ascending from a branched, sometimes prostrate and rooting base, from 8-30 cm. high, smooth, glabrous or finely puberulous below the inflorescence, with solitary or 2 to 3-nate branches above, internodes mostly exserted. Leaf-blades ovate-lanceolate to oblong-lanceolate from a cordate amplexicaul base, finely acuminate, 25 to over 50 mm. long by 6-12 mm. broad, flaccid, with scattered tubercle-based hairs on both sides, ciliate towards the base, primary lateral nerves 3-4 on each side, very fine ; ligules membranous, ciliolate, short, truncate ; sheaths lax, the upper very often more or less inflated and bladeless, more or less hirsute in the upper part with tubercle-based hairs and densely ciliate along the upper margins, nodes shortly bearded. Racemes 1 to about 9, in fascicles, born on filiform, ultimately long exserted peduncles, 2·5-15 cm. long, very slender, flexuous ; rhachis fragile ; joints 3·3 mm. long, usually shortly ciliate, but the uppermost cilia sometimes up to 1·6 mm. long, sometimes glabrous or nearly so ; pedicels reduced to a minute point or subule. Spikelets solitary, sessile, oblong-lanceolate in profile, somewhat oblique, laterally compressed, including the very minute glabrous or minutely puberulous callus, 3·3-4·2 mm. long. Involucral glumes subequal, lower subchartaceous, acute, scaberulous along the very slender 7-9 nerves or almost smooth towards the base, upper obliquely lanceolate to linear-lanceolate in profile, acute or minutely mucronate, 3- (rarely 5-) nerved, eciliate. Lower floral glume oblong, obtuse, hyaline, obscurely 2-nerved, shorter by $\frac{1}{3}$ than the involucral glumes, upper narrowly linear-lanceolate in profile, 2-2·7 mm. long, awn from near the base, usually 6·3 mm. long, more rarely down to 4·2 or up to 8·5 mm. long, very delicate, kneed and twisted below the middle. Stamens 2.

Locality : Gujarat : Chamargaon (Woodrow).—*Khandesh :* common (McCann !).—*Konkan :* very common (McCann !).—*Deccan*. Mahableshwar (Sedgwick and Bell 4501 !) ; Panchgani (Blatter and Hallberg B1244 !, B1252 !, B1257 !, B1266 !, B1273 !, B1290 !) Khandala, very common (McCann !).—*S. M. Country :* S. W. of Dharwar (Sedgwick and Bell 4434 !) ; Dharwar (Sedgwick 3098 !) ; Gadag (Talbot 2304 !) ; Belgaum (Ritchie 796A).—*Kanara :* Halyal (Talbot 2161 !) ; Yellapore (Talbot 1057 !).

Distribution : From Bihar southwards to Ceylon, Tropical Africa (Nileland, Upper and Lower Guinea, Mozambique District), introduced into Jamaica and Guadeloupe.

6. **Arthraxon jubatus**, Hack. Monogr. Androp. (1889), 358 ; Hook. f. in F. B. I. vii, 147 ; Cke. ii, 970.

Description : Cke. l.c.

Locality : Konkan : (Law, Stocks).—*Deccan*: Kori Fort, 12 miles south of Lonavla (Woodrow) ; Khandala, damp rocks (Hallberg 9788 !) ; Lohagad Fort, top (McCann 9789 !).

Distribution : W. Peninsula, apparently endemic.

31. CAPILLIPEDIUM, Stapf in Fl. Trop. Afr. ix, 169.

Annual or perennial grasses. Stems slender, simple or branched, sometimes very copiously, often bearded at the nodes. Leaf-blade with a rather conspicuous white midrib. Panicles delicate, when much divided the branchlets at length more or less divergent. Spikelets small, 2-nate, one sessile, the other pedicelled, similar in shape but differing in sex, in 1-2- (rarely up to 8-) jointed racemes at the ends of the capillary primary and secondary and often tertiary or even quaternary branches of a loose panicle ; joints and pedicels finely filiform, longitudinally grooved and hyaline in the groove, disarticulating horizontally ; sessile and pedicelled spikelets deciduous, the former with the adjacent joint and pedicel. Florets 2 in the sessile spikelet, lower reduced to an empty glume or quite suppressed in the pedicelled spikelets, upper hermaphrodite; one male or neuter, in the pedicelled spikelet. Sessile spikelet dorsally compressed, awned, callus small, shortly bearded. Involucral glumes equal, membranous to subherbaceous; lower 2-keeled, with narrow inflexed margins; upper boat-shaped, 3-nerved, keeled, grooved on both sides along the obtuse keel. Lower floral glume hyaline, nerveless, upper consisting of a hyaline, linear stipe, firmer upwards, passing into a slender awn. Pale 0. Lodicules 2, minute, glabrous. Stamens 3. Stigmas exserted laterally, longer than the styles. Grain oblong-ellipsoid or oblong, dorsally slightly compressed; embryo exceeding ½ of the grain. Pedicelled spikelet awnless, glume, if present, hyaline, nerveless.

Species 6, in tropical and subtropical Asia, Polynesia and Australia, tropical Africa.

Three species, described by Cooke (ii, 981, 982) under *Andropogon assimilis*, Steud., *A. Hugelii*, Hack., and *A. filiculmis*, Hook. f. belong to this genus.

I. Stems more or less suffrutescent below, stiff, erect
  1. Nodes of stem glabrous; callus shortly bearded ... ... 1. *C. assimilis.*
  2. Nodes of stem bearded; callus densely villous ... ... 2. *C. Hugelii.*
II. Stems decumbent and interlaced, very weak, filiform ... ... 3. *C. filiculmis.*

1. **Capillipedium assimile,** A. Camus, Graminées in H. Lecomte. Fl. Générale de l'Indo-Chine 7 (1922) 314; Haines Bot. Bihar and Orissa (1924), 1028 (*A. Camus prior fecit combinationem novam*).—*Andropogon assimilis*, Steud. in Zoll. Syst. Verz. (1854), 58; Syn. Gram. (1855), 397; Hook. f. in F. B. I. vii, 179; Cke ii, 981.—*A. montanus*, Benth. Fl. Hongk. 423, *non* Roxb., *excl. syn.*; Hack. Monogr. Androp. 490, *excl. syn.*—*Chrysopogon pictus*, Hance in Ann. Sc. Nat. ser. 5, v (1866), 252.—*C. glaucopsis*, Duthie Grass. N. W. Ind. 22.—*Raphis repens*, Nees ex Steud. l. c.

Description: Cke. l. c.

Locality: Khandesh: Toranmal, growing among Strobilanthus (McCann 9671!).—*Konkan:* Above Kenery Caves (McCann 9959!).—*Deccan:* in dry forest, between Mahableshwar and Panchgani, at 4,000 ft. (Sedgwick and Bell 4738!).—*Kanara:* Jugglepet, road side, common (Talbot 1386!).

Distribution: Temperate Himalaya, Khasia, Behar, N. Bengal, Rajputana, Central India, W. Peninsula, Java, China, Japan.

2. **Capillipedium Hugelii,** Blatter & McCann, *nov. comb.*—*Andropogon Hugelii*, Hack. Monogr. Androp. 492; Hook. f. in F. B. I. vii, 180; Cke. ii, 982.

Description: Cke. l. c.

Locality: Khandesh: Toranmal (McCann 9672!).—*Konkan:* Mulgaum (McCann 3664!).—*Deccan*: Khandala, St. Xavier's Villa (McCann 9423!); dry forests between Mahableshwar and Panchgani (Sedgwick 4738!); Panchgani (Blatter and Hallberg B1321!, McCann!).—*S. M. Country:* Deciduous forests west of Dharwar (Sedgwick 4498!).—*Kanara:* Halyal (Talbot 2082!); Ecumbi to Mungod (Hallberg and McCann A288!).

Distribution: Rajputana, Central Provinces, Central India, W. Peninsula.

3. **Capillipedium filiculme**, Blatter & McCann, *nov. comb.*—*Andropogon filiculmis*, Hook. f. in F. B. I. vii, 181; Cke ii, 982.

Description: Cke. l. c.

Locality: Konkan: Trombay (McCann A286!).—*Deccan:* Khandala to Karjat (Blatter and Hallberg A287!); Igatpuri (Blatter and Hallberg 5117!); Poona, in rocky places (Jacquemont 310); Donshi, Mawal Districts (Woodrow 26); Purandhar (McCann 5570!).—*S. M. Country:* forests near Dharwar (Sedgwick 1854!).

Distribution: W. Peninsula, apparently endemic.

32. AMPHILOPHIS, Nash in Britt. Man. Fl. N.U.S. ed. i, 71; Stapf in Fl. Trop. Afr. ix, 171.

Perennial grasses. Stems slender, simple or branched, bearded or beardless at the nodes. Panicles mostly subdigitate with a short primary axis, rarely the racemes on branches of the second order; racemes always shortly peduncled, Spikelets small, 2-nate, one sessile, the other pedicelled, similar in shape or the pedicelled reduced and smaller, the latter always different in sex except sometimes the lowermost pair which may be homogamous (male or neuter), on the fragile rhachis of many-jointed shortly peduncled racemes; joints and pedicels filiform, longitudinally grooved and hyaline in the groove, disarticulating horizontally; sessile and pedicelled (always ?) spikelets deciduous, the former with the adjacent joint and pedicel. Florets 2 in the sessile spikelets, lower reduced to an empty glume, upper hermaphrodite, 2 or 1 in the pedicelled spikelet, the lower male or neuter, the upper neuter or usually quite suppressed. Sessile spikelet dorsally compressed, awned; callus small, shortly bearded. Involucral glumes equal, thinly chartaceous to membranous; lower 2-keeled, with narrow sharply inflexed margins; upper boat-shaped, 3-nerved, acutely keeled. Lower floral glume hyaline, nerveless, upper a hyaline linear stipe, firmer upwards, passing into a slender awn. Pales 0 or very minute. Lodicules 2, minute, glabrous. Stamens 3. Stigmas exserted laterally usually low down, longer than the styles. Grain oblong, obtuse, dorsally slightly compressed; embryo about half the length of the grain. Pedicelled spikelet awnless, glumes, if present, hyaline, nerveless.

Species probably over 25, mostly in Tropical Asia.

Cke. (ii, 977–981) mentions 8 species which belong to the section *Amphilophis* of *Andropogon* : *Andropogon compressus*, Hook. f., *A. Woodrowii*, Hook. f., *A. pertusus*, Willd., *A. Kuntzeanus*, Hack., *A. ensiformis*, Hook. f., *A. concanensis*, Hook.f., *A. intermedius*, Cooke (*non* R. Br.), *A. odoratus*, Dna. Lisboa. All these are now being transferred to the new genus *Amphilophis*, Nash.

Key to the species (*after Cke.*)

A. Racemes digitate or fasciculate, the lower longer than the rhachis of the inflorescence
  I. Lower involucral glume of sessile spikelets villous below the middle
    1. Lower involucral glume not pitted
      (*a*) Upper involucral glume mucronulate ... 1. *A. compressa.*
      (*b*) Upper involucral glume obtuse ... 2. *A. Woodrowii.*
    2. Lower involucral glumes pitted ... ... 3. *A. pertusa.*
  II. Lower involucral glume of sessile spikelets glabrous below the middle (sparsely silky in *A. ensiformis*)
    1. Nodes of stem densely bearded ... 4. *A. Kuntzeana.*
    2. Nodes of stem glabrous
      (*a*) Leaves reaching 12 mm. broad ... 5. *A. ensiformis.*
      (*b*) Leaves reaching 3 mm. broad ... 6. *A. concanensis.*
B. Racemes panicled, the lower branches shorter than the rhachis of the inflorescence
  I. Non-aromatic; sheaths terete ... ... 7. *A. glabra.*
  II. Aromatic; sheaths compressed ... ... 8. *A. odorata.*

1. **Amphilophis compressa,** Blatter & McCann, *comb. nov. Andropogon compressus*, Hook. f. in F.B.I. vii (1896), 172; Cke. ii, 977.

Description : Cke. l.c.

Locality : Deccan : Khandala, plain behind the Saddle (Hallberg 9657!, Bhide!); Lonavla (McCann 9433!); Mawal (Woodrow!); Poona (Woodrow).

Distribution : Western Peninsula, apparently endemic.

2. **Amphilophis Woodrowii,** A. Camus. *Andropogon Woodrowii*, Hook. f. in F.B.I., vii (1896), 173; Cke. ii, 978.

Description : Cke. l. c.

Locality : Deccan : Khorbasa, Mawal Districts (Woodrow); Pand, 20 miles W. of Poona (Woodrow!).

Distribution : Western Peninsula, apparently endemic.

3. **Amphilophis pertusa,** Stapf in Fl. Trop. Afr. ix, 175; Haines Bot. Bihar and Orissa 1030.—*Holcus pertusus*, Linn. Mant. Alt. 301.—*Andropogon pertusus*, Willd. Sp. Pl. iv, 922; Beauv. Agrost. 131, t. 23, fig. 2; Roxb. Fl. Ind. i, 258; Hack. Monogr. Androp. 479 (vars. *genuinus et Wightii*); Duthie

Grass. N.W. Ind. 21 (*excl. Syn.*), Fodd. Grass. N. Ind. 38, t. 25; Boiss. Fl. Or. v. 464; Balf. f. Bot. Socotra 316; Hook. f. F.B.I. vii, 173; Cke. ii, 978.—*Lepeocercis pertusa*, Nees ex Steud. Syn. Pl. Glum. i, 364.

Vern. Names: Ghanga, marvel (Satara, Sholapur, Poona), payen, palva, palvan.

Description: Cke. ii, 978. A very variable plant. We must confess we find it impossible to follow various authors who have described a number of varieties. It would be easy to increase their number on merely morphological grounds, but the results would be highly unsatisfactory. It is only from genetical tests that we can expect to get an insight into the natural variations of this and other species of this genus.

Locality: Gujarat: Perim Island, Gulf of Cambay (Blatter 3814 !).—*Konkan:* Daman (Bhide !); St. Xavier's College compound, Bombay (McCann 9630 !, 9631 !).—*Deccan:* Nasik (Bourke 11 !); Rahuri (Nana A278 !); Khandala, Campoli (McCann 9961 !); Pashan (Gammie !); Lonavla (Woodrow); Agricultural College, Kirkee (Bhide !); Poona (Cooke); Panchgani (Blatter and Hallberg B1236 !), on edge of Tableland (Blatter 9962 !), on roadside 4,000 ft. (Sedgwick and Bell 4699 !); Satara (Lisboa); Sholapur (Lisboa); Joonur (Talbot !).—*S.M. Country:* W. of Dharwar, elevation 2,000 ft., rainfall 35″ (Sedgwick and Bell 4494 !); Dharwar, elevation 2,400 ft., rainfall 34″ (Sedgwick and Bell 4488 !); Kunur, elevation 2,000 ft., rainfall 35″ (Sedgwick and Bell 4953 !); Badami (Talbot 2944 !); Haveri (Talbot 2233 !); Gokak (Sheodye !).—*Kanara:* Halyal (Talbot 2080 !, 2106 !).

Distribution: More or less throughout India, chiefly in the drier parts, Ceylon, Afghanistan, Arabia, tropical Africa (Upper Guinea, Nileland, Mozambique District).

Uses: A good fodder grass. (See W. Burns, L. B. Kulkarni and S. R. Godbole: A study of some Indian grasses and grasslands. Mem. Dept. Agr. in India, xiv (1925), 47, 48.)

4. **Amphilophis Kuntzeana**, Haines Bot. Bihar and Orissa 1031.—*Andropogon Kuntzeanus*, Hack. Monogr. Androp. 478; Hook. f. F.B.I. vii, 175; Cke. ii, 979.

Description: Cke. l. c.

Locality: Konkan: (Stocks).—*Deccan:* (Woodrow 153 !); Mawal (Woodrow).

Distribution: Bihar, Central Provinces, W. Peninsula.

5. **Amphilophis ensiformis**, Blatter & McCann, *comb. nov.*—*Andropogon ensiformis*, Hook. f. in F. B. I. vii, 175; Cke. ii, 979.

Description: Cke. l. c.

Locality: Deccan: Lonavla (Woodrow !).

Distribution: W. Peninsula, apparently endemic.

6. **Amphilophis concanensis**, Blatter & McCann, *comb. nov.*—*Andropogon concanensis*, Hook. f. in F. B. I. vii, 174; Cke. ii, 980.

Description: Cke. l. c.

Locality: Konkan: Matheran (Woodrow !).—*Deccan*: Yenna River, Lingmala, Mahableshwar, 4,000 ft. elevation, 200″ rainfall (Sedgwick and Bell 4652 !); Lingmala, Mahableshwar (Blatter and Hallberg B1328 !); Khandala, in water courses, common (McCann 9651 !); Manmad, river-bed (Blatter A283 !);—*Kanara:* Kalanadi River, Supa, on rocks, elevation 2,000 ft., rainfall 100″ (Sedgwick and Bell 4857 !); Halyal (Talbot 2221 !); Goond (Talbot 2202 !); Gersoppa Falls, on rocks in river bed (Hallberg and McCann A279 !).

Distribution: W. Peninsula, apparently endemic.

7. **Amphilophis glabra**, Stapf in Fl. Trop. Afr. ix, 172.—*Andropogon glaber*, Roxb. Fl. Ind. i, 271; Steud. Syn. Pl. Glum. i, 392.—*A. punctatus*, Trin. Ic. t. 328, *non* Roxb.—*A. intermedius* var. *punctatus*, subvar. *glaber*, Hack. Monogr. Androp. 487.—*A. intermedius*, K. Schum. in Engl. Pfl. Ost.-Afr. C. 98; Hook. f. in F. B. I. vii, 175; Cke. ii, 980.—*A. intermedius*, var. *punctatus*, Stapf in Dyer, Fl. Cap. vii, 345.—*Amphilophis glabra*. Haines Bot. Bihar and Orissa 1028, *non* Stapf and *partim*.

It will be seen from the above synonymy that Stapf considers *Andropogon glaber*, Roxb. as the type of the species. Of *Andropogon intermedius*, R. Br. as conceived by Hackel he includes only the var. *punctatus*, subvar. *glaber*. Haines in his Bot. Bihar and Orissa, 1028, adopts Stapf's name *Amphilophis glabra* with the following synonyms: *Andropogon intermedius*, R. Br. *inc. A. glaber*, Roxb., *A. punctatus*, Roxb. and *A. montanus*, Roxb. ?

This is evidently not Stapf's *Amphilophis glabra*. Haines includes *Andropogon intermedius*, R. Br., whilst Stapf confines his species to var. *punctatus*, Haines has *A. punctatus*, Roxb. as a synonym, Stapf excludes it expressly.

Haines' description is much wider than that given by Stapf and includes Hackel's vars. *genuinus*, *Hænkei*, *punctatus* and *glaber*, and one of his own var. *hirta*. He says in a foot-note (p. 1029): ' These varieties are after Hackel and were described before I consulted Stapf's Gramineæ in Fl. Trop. Africa, where he reduces Hackel's *intermedius* to Roxburgh's *glaber*. The names (e.g. *genuinus*) in some cases become inapplicable if Roxburgh's *glaber* is the type. Var. *Hænkei* is, I think, a distinct species and easily distinguished in the field. It should be called *Amphilophis Hænkei*.'

Haines seems to overlook the fact that Stapf's *glabra* is restricted to one of Hackel's varieties of *Andropogon intermedius*, viz., *punctatus* and that, consequently not all of Hackel's names can be applicable.

In our opinion Haines is not justified in calling his species *Amphilophis glabra*, Stapf. As it includes practically the whole of *Andropogon intermedius*, R. Br. taken in Hackel's sense he might have called it *Amphilophis intermedia*, Haines, if that name had not been preoccupied by Stapf (Fl. Trop. Afr. ix, 174).

We are not arguing the point whether Stapf or Haines is right in the treatment of *Andropogon intermedius*, R. Br. *et auctorum ;* good reasons can be adduced for both cases. All we wish to say is that Haines' *Amphilophis glabra* is not *A. glabra*, Stapf.

Those who prefer to adopt Haines' *A. glabra* and Hackel's varieties might consider a remark made by Hackel himself (l.c. 487): '*A. fascicularis Thwaites Enum. Pl. Zeyl. p.* 437 *non Roxb. complectitur varietates* β [*Hænkei*] *et* δ [*punctatus*] *formis intermediis* (*spiculis in eadem panicula mixtis*) *conjunctas. Etiam in Bengalia transitus et ipsa varietas* β [*Hænkei*] *proveniunt ; in Himalaya, e. gr. pr. Simlah formæ inter* δ [*punctatus*] *et* ∝ [*genuinus*] *intermediæ inveniuntur*.'

We adopt Stapf's conception of *A. glabra* together with his description. Dr. Stapf was kind enough to name some of our Bombay specimens.

Description : Perennial. Rhizome very short, hard, innovations extravaginal, cataphylls ovate to lanceolate, acute, hard, smooth. Stems tufted, erect or shortly ascending, to over 1 m. high, rather stout below, glabrous, 5–7-noded, simple or very sparingly branched. Leaf-sheaths terete, glabrous, smooth, the intermediate and upper mostly shorter than the internodes, nodes glabrous or the upper bearded. Blades linear, long-tapering to a setaceous point, hardly broader, not or slightly contracted at the base, up to over 30 cm. by 8·5 mm. (mostly narrower), pale green, often turning reddish or purplish, glabrous, rarely with very fine, long, spreading, white hairs at and above the ligule, smooth except at the margins, midrib rather stout to very stout downwards, lateral nerves 3-4 on each side ; ligules truncate, very short, scarious. Panicle narrowly oblong, 10–23 cm. by 25–38 mm., erect, primary axis much longer than the lowest racemes, somewhat stout and (at least when mature) stiff, smooth, shortly bearded at the branch axils, otherwise glabrous and smooth ; branches whorled, up to 6 in a whorl or semiverticillate, or 2-nate or solitary from the weaker nodes, straight, 25–75 mm. long, the longer divided from 12 mm. above the base, few to 7-noded, secondary branches simple. Racemes 12–38 mm. long, straight or flexuous, usually purplish, inconspicuously white-villous ; joints and pedicels 2–3·3 mm. long, ciliate, uppermost cilia much longer than the rest, up to 1 mm. long. Sessile spikelet pale green or purplish throughout, including the small minutely bearded callus 3·3–3·8 mm. long. Involucral glumes equal ; lower truncate, slightly concave on the back, chartaceous-membranous, hairy below the middle, more rarely glabrous, keels rigidly ciliolate upwards, intracarinal nerves 4–5, very fine, evanescent upwards with or without a pit above the middle ; upper lanceolate, acute, 3-nerved, keel scabrid upwards, margins sparingly ciliate. Lower floral glume oblong, 2·7 mm. long, hyaline, nerveless, ciliate, upper an awn 6·3–12·7 mm. long, brown below, pale above the bend. Pedicelled spikelet neuter, mostly reduced to the glumes, narrowly linear-oblong to linear, 2·7–3·3 mm. long, glabrous, of the same colour as the sessile. Lower involucral glume rigidly and minutely ciliolate, 5-9-nerved, often rolled in, not pitted, upper hyaline, nerveless, often minute.

Locality : Konkan : Penn (McCann A282 !).—*Deccan :* Pimpalgam, on the brink of a stream (Bhide !) ; Lonavla (Hallberg 9955 !) ; Khandala, St. Mary's Ravine, on a water course (McCann 9435 !).

Distribution : More or less throughout India, Tropical Asia, N.E. Australia, Tropical Africa (Upper and Lower Guinea, Mozambique District, Nileland) Madagascar.

8. **Amphilophis odorata**, A. Camus. *Andropogon odoratus*, Dna. Lisboa in Journ. Bomb. Nat. Hist. Soc. iv, (1889), 123, *cum ic.* and vi (1891), 68, 203 ; Hook.f. in F.B.I. vii, 177 ; Cke. ii, 981.

Description : Cke. l.c.

Locality : Khandesh (Lisboa).—*Konkan :* Khardi (Mrs. Lisboa).—*Deccan :* Igatpuri (McCann A281 !), Lonavla ; (Mrs. Lisboa, Bhide !) ; plain at foot of Lohagad (McCann 9956 !) ; Pand, 20 miles W. of Poona (Herb. Econ. Bot. Poona !) ; Mawal, Poona District (Woodrow).

Distribution : W. Peninsula, apparently endemic.

33. DICHANTHIUM, Willemet in Usteri Ann. xviii (1796), 11 ; Stapf in Prain Fl. Trop. Afr. ix, 177.

Perennial or annual. Stems simple or branched, usually many-noded, bearded or beardless at the nodes. Panicles usually subdigitate with a short or very short primary axis, rarely the latter elongated ; racemes always shortly peduncled. Spikelets small, 2-nate, one sessile, the other pedicelled, similar in shape, different in sex, except the lowermost 1 or 2 pairs (sometimes 3 or 4) of each raceme which are (with occasional exceptions in *D. annulatum*) homogamous (male or neuter), in many-jointed, shortly peduncled, subdigitate, rarely subpanicled or racemosely arranged, racemes ; joints and pedicels filiform, solid, disarticulating subhorizontally except the lowest barren pairs ; fertile sessile and pedicelled spikelets deciduous, the former with the adjacent joint and pedicel. Sessile spikelet dorsally compressed, awned except the basal homogamous ones ; callus small, shortly bearded. Involucral glumes equal, thinly chartaceous, lower usually very obtuse, 2-keeled, with narrow sharply inflexed margins, upper boat-shaped, 3-nerved, acutely keeled. Lower floral glume hyaline, nerveless, upper reduced to the hyaline base of a slender awn ; pale minute or absent. Lodicules 2, minute, glabrous. Stamens 3. Stigmas exserted laterally at or above the middle or near the tips. Grain oblong, obtuse, dorsally compressed ; embryo rather more than half the length of the grain. Pedicelled spikelet awnless. Lower involucral glume oblong, many nerved, upper flat with sharply inflexed margins closing over the hyaline lower floral glume if present and the stamens, upper floral glume usually 0, never awned.

Species 10 in the tropical and warm-temperate regions of the Old World.

So far 4 species were known from the Presidency and described by Cooke under *Andropogon armatus*, Hook. f., *A. Cookei*, Stapf, *A. caricosus*, Linn. and *A. annulatus*, Forsk. To these we have added 2 new species: *Dichanthium panchganiense*, Blatter & McCann, and *D. McCannii*, Blatter.

Key to the species

A. Racemes digitate (sometimes solitary in *D. caricosus*), 25 mm. long or longer
  I. Lower involucral glumes of pedicelled spikelets armed with marginal bulbous-based bristles
    1. Lower involucral glume of pedicelled spikelet always pitted ... ... 1. *D. panchganiense.*
    2. Lower involucral glume of pedicelled spikelet not pitted
      (*a*) Ligule absent ... ... 2. *D. armatum.*
      (*b*) Ligule present ... ... 3. *D. McCannii.*

II Lower involucral glumes of pedicelled spikelets not armed with marginal bristles
  1. Nodes of stem glabrous; ligule a shortly ciliate small membrane ... 4. *D. caricosum.*
  2. Nodes of stem bearded; ligule large, membranous ... ... 5. *D. annulatum.*
B. Racemes solitary, less than 25 mm. long ... 6. *D. serrafalcoides.*

1. **Dichanthium panchganiense**, Blatter & McCann in Journ. Bomb. Nat Hist. Soc. xxxii (1927), 381.

Locality: Deccan: Panchgani (McCann !)

Distribution: W. Peninsula, apparently endemic.

2. **Dichanthium armatum**, Blatter & McCann, *comb. nov.—Andropogon armatus*, Hook. f. in F. B. I. vii, 197 : Cke. ii, 987.

Description: Cke. l. c.

Locality : Konkan : Stocks (teste Hook. f.).—*Deccan*: Kalsabai Hills, Nasik District (Patwardhan 1183 !); Gira Hill, Khandala (McCann 9430 ! 9431 !); Lohagad (McCann 3871 !); Panchgani (Blatter and Hallberg B1212 !); Pasarni Ghat (Blatter and Hallberg B1304 !).

Distribution : W. Peninsula, apparently endemic.

3. **Dichanthium McCannii**, Blatter in Journ. Bomb. Nat. Hist. Soc. xxxii (1927), 381.

Locality : Deccan : Panchgani (McCann !).

Distribution: W. Peninsula, apparently endemic.

4. **Dichanthium caricosum**, *A. Camus*: Note sur le genre *Dichanthium* Willemet in Bull. Mus. Hist. Nat. (Paris) 27 (1921), 549.—*Andropogon caricosum*, Linn. Sp. Pl. ed. 2 (1763), 1480; Hack. Monogr. Androp. 567; Hook. f. in F. B. I. vii, 196; Cke. ii, 987; Haines Bot. Bihar and Orissa, 1039.—For further synonyms see Hook. f. l. c.

Three authors have made the new combination *Dichanthium caricosum :* (*a*) *A. Camus* l. c. (*b*). Stapf in Ridley Fl. Malay Penins. v (1925), 210. (*c*) Haines in Bot. Bihar and Orissa (1924), 1039. *A. Camus* has therefore to be adopted as authority for *D. caricosum.*

We are not trying to describe varieties or forms of this very variable species.

Vern. Names : Marvel (Mar.), Zinzvo (Guj.).

Description : Cke. l. c.

This species can, according to Burns and others[1] be distinguished from *D. annulatum*, Stapf by the following characters :—

	Dichanthium caricosum.	*Dichanthium annulatum.*
Habit :	Big and tufted with terminal and axillary inflorescences.	Medium size with terminal inflorescences.
Nodal hairs on stem :	Short.	Long.
Colour of inflorescence :	Light purplish-green.	Purple.
Hairs of inflorescence :	Short.	Long.

Haines l. c. believes there is no single character by which *D. caricosum* can be distinguished from *D. annulatum.* 'I have,' he says, 'tested all those given in the F. B. I. and found them fail on specimens named by Sir J. D. Hooker himself; the key characters in Bengal plants are also unworkable as applied to the same specimens, many of which have bearded nodes, and the character of spiral or subdistichous spikelets is difficult to apply. Linnæus described *Andropogon caricosus* as with solitary spikes, and Willdenough (sic !) adds 'leaves with sparse hairs and sheaths hirsute at the base' (probably he refers to the nodes).'

In his key-characters Haines says that in *D. caricosum* the callus is glabrous. This seems to be a mistake. Hackel calls the callus *Brevissime barbatus*, Cooke has 'bearded,' Rangachari describes it as 'short and shortly hairy below.' We have always found it bearded.

Locality : Gujarat : Surat, road sides (Sedgwick 315 !).—*Khandesh :* Toranmal (McCann 9669 !); Tapti, N. E. of Bhusawal (Hallberg 5111 !);

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[1] W. Burns, L. B. Kulkarni and S. R. Godbole : A Study of Some Indian Grasses, in *Mem. Dept Agr. Ind.*, xiv (1925), 46.

N. slope of Chanseli (McCann 9968 !).—*Konkan :* Parsik, railway tract (McCann 9633 !).—*Deccan :* Junnar (Mamlatdar of Junnar !) ; Shevgaon (Mamlatdar of Shevgaon !) ; Lohagad, half-way up (McCann 9627 !) ; Agricultural College Farm, Poona (Herb. Econ. Bot. Poona !) ; Khed (Mamlatdar of Khed !) ; Purandhar (McCann 5570 !) ; Bairawady, Purandhar (McCann 5075 !) ; Panchgani (Blatter 3803 ! , Blatter and Hallberg B1223 !) ; between Mahableshwar and Panchgani, elevation 4,000 ft. (Sedgwick and Bell 4743 ;).—*S. M. Country :* Dharwar, elevation 2,400 ft., rainfall 34″ (Sedgwick 1828 !).—*Kanara :* Halyal (Talbot 2427 !).

Distribution : India, Burma, Ceylon, Mauritius, China.

Uses : A good fodder grass.

5. **Dichanthium annulatum**, Stapf in Prain Fl. Trop. Afr. ix, 178 ; Haines Bot. Bihar and Orissa 1039.—*Andropogon annulatus*, Forsk. Fl. Aegypt.-Arab, (1775), 173 ; Duthie Fodd. Grass. N. Ind. 33, t. 20 ; Hack. Monogr. Androp. 570 ; Hook. f. F.B.I. vii, 196 ; Cke. ii, 988.— For further synonyms see Hook. f. l. c.

Vern. Names : Zinjoo, handi daroya, daroya (Surat), dhrow (Broach), zinzma (Charodi), jinjva (Panch-Mahals), marvel (Poona), sheda, sam-payen palvan-hullu, marwalyan-hullu (Dharwar).

Description : Cke. l. c.

Locality : *Sind* : Jamesabad (Sabnis B972 !) ; Mirpurkhas (Sabnis B1028 !, B1185 !) ; Hyderabad (Sabnis B51 !) ; Pad-Idan (Sabnis B515 !) ; Larkana (Sabnis B462 !) ; Nasarpur (Sabnis B1140 !) ; Tatta, Kullan Kote Lake (Blatter and McCann D667 !) ; Tatta, tombs (Blatter and McCann D668 !) .—Gujarat : Kabirwad (Chibber !) ; Nadiad Farm (Herb. Econ. Bot. Poona !) .—*Khandesh :* Amboli, Bori River (Blatter and Hallberg 5148 !) ; Dadgaum (McCann 9665!) ; Toranmal (McCann 9670 !) ; Bor, Bori River (Blatter and Hallberg 4428 !); Umalla, Tapti Bank (Blatter and Hallberg 5228 !).—*Konkan :* Sion (McCann 3672 !) ; Sewri (McCann 3587 !) ; Parsik, railway line (McCann 9654 !) ; Campoli (McCann 5356 !).—*Deccan :* Kirkee to Poona, railway line (Garade 83 !) ; College Garden, Poona (Garade !) ; Chattarshinji Hill, Poona (Ezekiel) ; Trimbak (Chibber !) ; Khandala, very common (McCann 5297 !) ; Manmad Blatter 9970 !) ; Purandhar, north foot (McCann 9421 !).—*S.M. Country :* Devikop, elevation 1,800 ft., rainfall 40″ (Sedgwick 3984 !).—*Kanara :* Halyal (Talbot 2081 !) ; Kulgi (Talbot 2299 !).

Distribution : Tropical Africa (Nileland, Mozambique District), from Morocco through North Africa, the Orient and India to China and Australia, Pacific Islands.

Uses : Considered good fodder.

6. **Dichanthium serrafalcoides**, Blatter & McCann, *nov. comb.*—*Andropogon Cookei*, Stapf ex Woodrow in Journ. Bomb. Nat. Hist. Soc. xiii, 438 (*nomen tantum*) ; Cke. ii, 986 (*descriptio*).—*A.* (*Dichanthium* ?) *serrafalcoides*, Cooke *et* Stapf in Kew Bull. (1908), 450.

The systematic position of this species is somewhat doubtful. Cooke already found that it does not agree with Hackel's subgenus *Dichanthium*, but he adds: ' It is the only subgenus into which it will fit at all.' Cooke and Stapf, when describing the same species under a different name, remark : '*Ob spiculas secundarias infimas saepissime neutras caeterum eadem forma ac fertiles si vis ad Dichanthiun referendus, sed nulli speciei arcte affinis spiculis maiusculis in racemos spiculis Serrafalci haud dissimiles congestis insignis.*' Following this suggestion we have put it under *Dichanthium.*

Description : Cke. ii, 986.

Locality: Deccan : Lonavla (Bhide !); Khandala, Echo Point (McCann 9403!); Kalanbai Hills (Patwardhan !) ; Sakar-Pathar near Lonavla (Woodrow !) ; Mahableshwar (McCann !) ; Panchgani (McCann !, Blatter and Hallberg B1250 !).

Distribution : W. Peninsula, apparently endemic.

34. EREMOPOGON, Stapf in Prain Fl. Trop. Afr. ix (1917), 182.

Perennial or annual grasses. Stems slender, simple below, more or less branched above, the branches often gathered in fastigiate bundles, each supported by a bladeless sheath and terminated by a solitary raceme. Spikelets small, 2-nate, one sessile, the other pedicelled, similar in shape, different in sex, on the fragile rhachis of many-jointed solitary spatheate racemes which are frequently gathered in fastigiate bundles, rarely the lowermost 1-3 pairs homogamous; joints and pedicels filiform, compressed, solid or slightly grooved, disarticulating horizontally; spikelets deciduous, the sessile with the adjacent joint and pedicels. Sessile spikelet dorsally compressed, awned; callus small, shortly bearded. Involucral glumes equal, thinly chartaceous to membranous, lower 2-keeled, with narrow inflexed margins, upper boat-shaped, 3-nerved, acutely keeled. Lower floral glume hyaline, nerveless, upper reduced to a hyaline upwards firmer linear stipe passing into a slender awn. Stamens 3. Stigmas exserted laterally near the middle of the spikelet, longer than the styles. Pedicelled spikelet awnless; somewhat similar to the sessile.

Species about 5, in the tropical and warm-temperate parts of the Old World. Cooke knew one species from the Presidency which he described under the name of *Andropogon foveolatus*, Del. We add *Eremopogon Paranjpyeanum*, Blatter and McCann.

1. Lower involucral glume of sessile spikelet 4-nerved ... ... 1. *E. foveolatus*.
2. Lower involucral glume of sessile spikelet faintly 5–7-nerved ... ... 2. *E. Paranjpyeanum*

1. **Eremopogon foveolatus**, Stapf in Prain Fl. Trop. Afr. ix (1917), 183.—*Andropogon foveolatus*, Del. Fl. Egypte 16, t. 8, fig. 2; Duthie Fodd. Grass. N. Ind. 35, t. 22; Hack. Monogr. Androp. 402; Hook. f. F. B. I. vii, 168; Cke. ii, 977.—*A. strictus*, Roxb. Fl. Ind. i, 260.—*A. monostachyus*, Spreng. Pug. ii, 9.—*Hypogynium foveolatum*, Haines Bot. Bihar and Orissa (1924), 1041.

Description: Cke. l. c.

Locality: *Sind*: Sehwan to Laki, foot of hills (Sabnis B 651 !).—*Gujarat*: Road to Lasandra (Chibber !); Bhuj Hill, Cutch (Blatter 3765 !).—*Khandesh*: Umalla, Tapti Bank (Blatter and Hallberg 5222 !); Bhusawal (McCann 4243 !); Bor, Bori River (Blatter and Hallberg 4309 !); Naradana (Blatter and Hallberg 5180 ;).—*Konkan*: Parel, poor specimen (McCann 5373 !).—*Deccan*: Panchgani, roadside, elevation 4,000 ft., rainfall 60″ (Sedgwick and Bell 4735 !); Yeola (Herb. Econ. Bot. Poona !); Arangaon, Ahmednagar (Ryan !); Chattarshinji Hill (Ezekiel !); Deolali (Blatter 4550 !); Manmad (Blatter A261 !); Panchgani (Blatter and Hallberg B1245 !).—*S. M. Country*: Dharwar, elevation 2,400 ft., rainfall 34″ (Sedgwick 1825 !); Haveri (Talbot 2229 !).

Distribution: Tropical Africa (Upper Guinea, Nileland), Canaries, from Egypt and Tropical Arabia to the drier parts of India.

2. **Eremopogon Paranjpyeanum**, Blatter & McCann, *comb. nov.*—*Andropogon Paranjpyeanum*, Bhide in Journ. and Proc. Asiat. Soc. Beng., New series, vii (1911), 514.

Description: A delicate-looking grass. Stems slender, erect, 30–45 cm. high; upper nodes pubescent; leaves 2·5–7·5 cm. by 2 mm., subcordate at base, long-hairy on both sides, the margins thickened and minutely irregularly repand and spinulosely serrulate; sheaths glabrous; ligule a short erose membrane. Racemes solitary, 12–25 mm. long (without the awns), on a very slender peduncle. Sessile spikelets 3 mm. long. Lower involucral glume oblong, obtuse, faintly 5–7-nerved, glabrous, margins narrowly incurved, keels shortly ciliate at the apex, upper just a little longer than the lower, 3-nerved, oblong, apiculate. Lower floral glume shorter than the involucral glumes, hyaline and with ciliate margins, epaleate, upper floral glume consisting of the narrow base of the awn, just a little more than half as long as the lower involucral glume, obscurely margined and 1-nerved with 2 obscure narrow lobes at the apex, and an interposed slender, twisted, scabrid awn about 4 cm. long, bearing a bisexual flower. Pedicelled spikelets about 4 mm. long. Lower involucral glume oblong, obtuse, 7–9-nerved, margins incurved and broadly winged at the keels, wings shortly ciliate towards the apex, upper involucral glume a little shorter than the lower, oblong, acute, 3-nerved, margins ciliate. Lower floral glume shorter than the upper involucral, hyaline, ciliate, faintly 3–5-nerved, epaleate, male. Joints and pedicels compressed, obliquely truncate, $\frac{1}{2}$–$\frac{2}{3}$ as long as the sessile spikelets and ciliate with short white hairs on both sides.

Locality: *S. M. Country*: Castle Rock (Bhide !).

Distribution: So far endemic.

35. SCHIZACHYRIUM. Nees Agrost. Bras. 331. Stapf in Prain Fl. Trop. Afr. ix, 1184.

Annual or perennial grasses, rarely suffrutescent, never very tall. Stems slender. Leaf-blades folded in bud, usually narrow. False panicles varying from very loose and scanty to densely fascicled; spathes mostly very narrow, scarious, membranous or lower down herbaceous. Spikelets 2-nate, of each pair differing in sex and mostly also more or less in shape and size, one sessile the other pedicelled, on the articulate fragile rhachis of many-jointed solitary racemes terminating the culms and their branches, supported by spathes and often collected into a false panicle, the sessile spikelets falling with the contiguous joint and the accompanying pedicelled spikelet; joints and pedicels thickened upwards, often rather stout with a scarious cupuliform and more or less dentate terminal appendage. Sessile spikelets dorsally compressed or sometimes in their lower half almost terete, awned; callus short with a short beard at the very base. Involucral glumes equal or subequal, lower chartaceous to subcoriaceous, more or less convex or flat on the back with, at least from the middle upwards, sharply inflexed and mostly narrow margins, 2-keeled, the keels running out into teeth or mucros, upper thinner to membranous, narrowly boat-shaped to dorsally flattened, keeled (at least upwards), 1–3-nerved, the delicate margins ciliolate Floral glumes, ciliolate, hyaline, lower membranous downwards and often purplish, 2-nerved, upper usually 2-fid or 2-dentate, rarely entire, awned, awn from the sinus or continuing the entire valve, Pale 0 or a microscopic hyaline scale. Lodicules 2, minute, glabrous. Stamens 3, rarely 2. Stigmas laterally exserted low down; styles terminal. Grain narrowly linear in outline or tapering upwards, subterete; embryo short. Pedicelled spikelet similar to the sessile, but usually relatively broader and flatter, or more or less reduced and then sometimes quite small. Involucral glumes more or less membranous, the lower aristulate or muticous. Floral glumes, if present hyaline, ciliate, muticous.

Species about 50, in the tropics of both hemispheres.

1. **Schizachyrium brevifolium**, Nees Agrost. Bras. 332; Miq. Fl. Ind. Bat. iii, 495; Stapf in Prain Fl. Trop. Afr. ix, 187; Haines Bot. Bihar and Orissa 1042. — *Andropogon brevifolius*, Sw. Prodr. Veg. Ind. Occ. 26, Fl. Ind. Occ. i, 209; Hack. in. Monogr. Androp. vi, 363 (excl. var. *fragilis*); Duthie Grass. N. W. Ind. 19, Fodd. Grass. N. Ind. 34; Hook. f F.B.I. vii, 165.—*A. obtusifolius*, Poir. Encycl. Suppl. i, 583.—*A. parvifolius*, Roxb. Fl Ind. i, 277.—*A. tenellus* Presl. Rel. Hænk. i, 335.—*A. debilis*, Kunth Enum. Pl. i, 488.—*A. floridus*, Trin. in Mem. Acad. Petersb. 6 ser. ii, 265.—*Pollinia brevifolia*, Spreng. Syst, i, 288.

Description: Annual. Stems weak, up to 60 cm. long, usually ascending from a decumbent base, rarely erect many-noded, branched from most of the nodes; branches often 2–4-nate and dividing again, very slender to filiform, geniculate, glabrous, the lower internodes usually much compressed. Leaf-blades linear, constricted at the junction with the sheath, the lower and those of the primary branches obtuse or sub-obtuse or suddenly narrowed to a sharp point, 25–38 mm. long and 2–6·3 mm. wide, the upper and those of the secondary and tertiary branches much narrower and more acute, often glaucescent, smooth except along the margins and the lower side of the midrib, nerves very fine. Ligules membranous, very short, ciliolate. Sheaths compressed, the lower keeled, somewhat lax, glabrous, smooth, the uppermost spathe-like; leaves like the spathe of the inflorescence ultimately turning reddish. Spathes on subcapillary curved or flexuous branchlets, very narrow, acute, reaching to the base of the racemes or slightly exceeding them; racemes borne on filiform upwards clavate peduncles, slender from less than 12 mm. to slightly over 25 mm. long, 5–11-jointed; joints 2–2·7 mm. long, widening upwards from a slender base, tips 2-dentate glabrous, smooth; pedicels as long as the joints, very slender and only slightly thickened upwards. Sessile spikelets linear-lanceolate, acuminate, more or less convex on the back, pale green, about 3·3 mm. long including the minute callus, which is more or less shortly bearded, at least on the sides. Involucral glumes equal, lower thinly chartaceous, 2-dentate, scaberulous along the keels, with very fine intracarinal nerves, smooth or very minutely scaberulous on the back; upper boat-shaped, acute, 1-nerved, ciliolate. Lower floral glume elliptic, obtuse, hyaline, nerveless, ciliolate, upper 2-fid almost to the base, 1·6 mm. long, segments linear-oblong, subobtuse, sparingly ciliolate, awn 8·5–12·7 mm. long. Anthers 0·5 mm. long, deep red or purple. Grain sublinear, tapering upwards. Pedicelled spikelet reduced to a minute glume, often passing indistinctly into the pedicel and produced into a bristle-like awn, about 4·2 mm. long.

Locality : S. M. Country : Badami (Talbot 2930 !).

Distribution : Widely distributed throughout the tropics.

36. ANDROPOGON, Linn.; Stapf in Prain Fl. Trop. Afr. ix, 208.

After the restoration of Hackel's subgenera to the rank of genera, the general characters of *Andropogon* itself must be modified in many ways :

Mostly perennial grasses of various habit. Spikelets 2-nate, the sessile and pedicelled differing from one another in sex and more or less heteromorphous, all pairs similar, or if the lowest sessile spikelet male or imperfect then resembling the others. Spikes (spiciform racemes) many-jointed, fragile, paired (very rarely solitary) or corymbose (digitate or subdigitate) on terminal peduncles, embraced below by a spathe-like leaf (spatheole), frequently 2 or more pairs with their spathes subtended by a common spathe and so on to more composite branching, the whole forming a false panicle ; the sessile spikelets falling with the contiguous joint and the accompanying pedicel ; joints and pedicels filiform or thickened upwards and then the tips frequently more or less cupular or auricled Sessile spikelets dorsally or laterally compressed, nearly always awned ; callus short, mostly quite obtuse, shortly bearded. Involucral glumes equal or subequal, subcoriaceous to membranous, lower flat or concave or channeled on the back with at least from the middle upwards sharply inflexed margins, 2-keeled ; upper more or less boat-shaped, keeled upwards, 3–1-nerved, sometimes aristulate. Floral glumes ciliate or ciliolate, rarely glabrous, lower hyaline, 2-nerved, upper 2-fid or 2-dentate, hyaline or firmer and sometimes substipitiform below the insertion of the awn. Pale a hyaline nerveless scale or 0. Lodicules 2, minute, glabrous. Stamens 3. Stigmas laterally exserted ; styles terminal. Grain narrowly lanceolate to oblong in outline, subterete to planoconvex ; embryo about half the length of the grain. Pedicelled spikelets often very different from the sessile in shape and less so in size, always more or less compressed dorsally, never concave or channelled on the back, sometimes reduced and then often small or quite suppressed. Involucral glumes herbaceous-chartaceous to membranous, the lower muticous or very rarely aristulate. Floral glumes, if present, hyaline, ciliate, muticous.

Species about 100, mostly in the tropics of both hemispheres.

1. **Andropogon pumilus**, Roxb. Fl. Ind. 1 (1832), 273 ; Steud, Syn. Gram. 388 ; Hook f. in F.B.I. vii, 170 ; Cke. ii, 976 ; Haines Bot. Bihar and Orissa 1044.—*A. demissus*, Steud, l.c.—*A. pachyarthrus*, Hack. Monogr. Androp. 449 ; Duthie Grass. N. W. Ind. 21, Fodd. Grass. N. Ind. t 39.

Vern. Names : Zinzvo (Surat), bærki, gondwal, lalgavat, tambrut, gondal, chiman chara, malakava.

Description : Cke. l.c.

Locality : Gujarat : Nadiad farm (Herb. Econ. Bot. Poona !) ; Surat (Dalzell).—*Khandesh :* Bhusawal (McCann 5451!) ! Bor, Bori River (Blatter and Hallberg 5116 !) ; to Naradana (Blatter and Hallberg 5207 !).—*Deccan :* Pashan (Gammie !) ; Bairawadi, Purandhar (McCann 5054 !) ; Manmad (Blatter A262 !) ; Shinda (Sabnis A260 !) ; Panchgani (Blatter and Hallberg B1268 !, B1274 !, B1326 !).—*S. M. Country :* Haveri (Talbot 2230 !) ; Dumbal (Talbot 2318 !) ; Harsol (Sedgwick 1083 !) —*Kanara :* Karwar (Lisboa).

Distribution : Nepal, Bihar, Rajputana, Central Prov., W. Peninsula.

37. CYMBOPOGON, Spreng.; Stapf in Prain Fl. Trop. Afr. ix, 265.

Perennial, densely tufted and usually aromatic grasses. Leaves often very coarse. Panicles frequently much compound and contracted, spatheate. Spikelets 2-nate, those of each pair differing in sex and more or less in shape—except those of lowest pair of the lower or of both racemes which are homogamous (male or neuter)—one sessile, the other pedicelled on the articulate fragile rhachis of many-jointed paired racemes, terminating the culms and their branches ; raceme-pairs supported by a spatheole, collected into often decompound or supra-decompound spatheate panicle ; the fertile spikelets falling with the contiguous joint and the accompanying pedicel ; joints and pedicels filiform or linear with frequently more or less cupular or auricled tips, those of the lowest pair (raceme-base) often conspicuously swollen, oblong or barrel-shaped and hard. Sessile spikelets (above the lowest) female or hermaphrodite, dorsally, rarely, laterally, compressed, awned (normally); callus very short, obtuse, shortly bearded. Involucral glumes equal or subequal, more or less chartaceous, lower almost flat or slightly depressed or narrowly grooved on the back, with at least from the middle upwards sharply inflexed margins, 2-keeled, upper more or less boat-shaped, keeled upwards, usually 1-nerved. Floral glumes ciliate or ciliolate (sometimes obscurely), lower entire, hyaline, 2-nerved, upper 2-fid or 2-lobed, hyaline, rarely firmer and almost stipe-like below the insertion of the awn; column of awn, if any, smooth. Pale 0. Lodicules 2, minute, glabrous. Stamens 3. Stigmas laterally exserted; styles terminal. Grain oblong in outline, subterete to plano-convex in cross-section; embryo about half the length of the grain. Pedicelled spikelets usually slightly different in shape and size from the sessile, but never depressed or grooved on the back. Involucral glumes muticous, lower chartaceous to sub-chartaceous upper thinner. Lower floral glume hyaline, 2-nerved, upper 0, but usually a male flower present.

Species about 36, in the tropical, more rarely in the subtropical regions of the Old World.

Cooke mentions one indigenous (*Andropogon Jwarancusa*, Jones) and one cultivated species (*Andropogon Schœnanthus*, Linn.) belonging to this genus. We add two indigenous species and a cultivated one:

Key, mainly after Stapf :

A. Blades long, hard, rough-edged throughout, filiform to linear; lower involucral glume of sessile spikelet flat or concave between the keels

  I. Raceme-joints villous all over, hairs long, more or less concealing the sessile spikelets; awn usually a straight, very short bristle

    1. Basal leaf-sheaths in dense tufts, tightly clasping, thickened below; blades more or less filiform and flexuous, except when very short; raceme-fascicles more or less simple ... 1. *C. Schœnanthus.*

    2. Basal leaf-sheaths ultimately loosened and curled; blades flat; raceme-fascicles compound ... ... 2. *C. Jwarancusa.*

  II. Raceme-joints bearded along the sides, but hairs not concealing the sessile spikelets; fertile spikelets awnless ... 3. *C. citratus.*

B. Blades flat, 5–30 mm. wide, rounded to subcordate and stem-clasping at the base, of a soft texture, with smooth edges, at least in the lower part; lower involucral glume of sessile spikelet with a narrow groove from the middle downwards corresponding to a keel inside

  I. Blades 10–30 mm. wide (rarely under 10 mm.), somewhat fat, rich green, at least above; panicles 10–30 cm. long, turning reddish when mature ... 4. *C. Martini.*

  II. Blades 2–6 mm. wide, thin, glaucous; panicles 10–20 cm. long, glaucous or straw-colour when mature ... ... 5. *C. cæsius.*

1. **Cymbopogon Schœnanthus,** Spreng. Pug. ii (1815), 15, *non* Schult.; Stapf in Kew Bull. (1906), 303–313, 352–353, in Prain Fl. Trop. Afr. ix, 268.—*C. arabicus*, Nees ex Steud. Syn. Pl. Glum. i (1855), 387.—*C. Arriani*, Aitch. Cat. Punj. Pl. (1869), 174.—*C. Circinnatus*, Hochst. ex Hack. in Monogr. Androp. 599.—*Andropogon Schœnanthus*, Linn. Sp. Pl. ed 1 (1753), 1046 (*non Hackel et plurimorum auct.*).—*A. bicornis*, Forsk. Fl. Aegypt.—Arab. (1763), 173, *non* Linn.—*A. laniger*, Desf. Fl. Atl. ii (1800), 379; Boiss. Fl. Or. v, 465; Balfour Bot. Socotra, 316; Hack. in Monogr. Androp. 598; Benth. in Hook. Ic. Pl. t. 1871.—*A. Olivieri*, Boiss. Diagn. Pl. Or. ser. i,

fasc. v (1844), 76.—*A. circinnatus*. Hochst. *et* Steud. Syn. Pl. Glum. i (1855), 387.—*A. Arriani*, Edgew. in Journ. Linn. Soc. vi (1862), 208.—*A. Jwarancusa*, subsp. *laniger*, Hook.f. F.B.I. vii. 203; Cke. ii, 976 (*var. tantum*).—*Gymnanthelia lanigera*, Anderss. in Schweinf. Beitr. Fl. Aethiop. 306 (*nomen tantum*).

For a discussion of the foundation of this species see Stapf in Kew Bull. (1906), 303-305.

Description: Perennial, compactly cæspitose, with numerous intravaginal innovations, 15-45 cm. high. Culms erect, slender, few— to 4-noded and simple below the inflorescence, terete, glabrous, very rarely with a few small hairs at the nodes. Leaf-blades semiterete, filiform, wiry, flexuous, very firm and often circinate upwards, rounded on the back, channelled on the face, or those of the culms somewhat flatter and shorter, up to more than 23 cm. long, 1 mm. in diameter, glabrous, finely scaberulous on the nerves below, though often smooth to the touch, pale, glaucous, evenly 7-9-nerved, the midrib showing only above as a broad, white band. Ligules membranous to scarious, oblong, truncate, ciliate, up to 3·3 mm. long. Sheaths very firm, smooth, glabrous, tight, those of the innovations and base of the culms widened at the base, very tough and long-persistent, straw-coloured, up to 13 cm. long. Spatheate panicle narrow, 8-30 cm. long, few—to 7-noded lower internodes 5-7·5 cm. long, upper rapidly decreasing in length, slender, glabrous; lowest primary branch rarely undivided at the base, 3-2-noded and up to 15 cm. long, usually forming up to 4-rayed tiers; lowest subtending sheaths with foliaceous blades; rays finely filiform, 2·5-3·7 cm. long, rarely to over 5 cm., glabrous; spathes narrowly lanceolate, subherbaceous, often tinged with pale purple, with a short blade or the upper bladeless and produced into a setaceous point, 3·7-4·3 cm. long, glabrous. Spatheoles very narrow, acute or with a setaceous point, 12-25 mm. long, pale or straw-coloured; peduncles finely filiform, widened upwards 3·3-4·2 mm. long, tips truncate. Racemes 2-nate, more or less divaricate, at length epinastically deflexed, 1-2 mm. long, white-villous, pale or tinged with purple, one subsessile, the other with a bare base, 1-2 mm. long, bases puberulous to pubescent in the fork, ciliate-bearded upwards, with minutely cupular and denticulate tips, that of the subsessile raceme as well as the adjacent pedicel stout, elliptic to elliptic-oblong in outline and convex on the back, ultimately more or less glabrescent and glossy; fertile joints filiform, slightly widened towards the oblique subcupular auricled tips, 2·7-3·3 mm. long, densely hairy to villous from the back and the angles; adjacent pedicels similar to the joints but more slender. Homogamous pair of spikelets one at the base of the sessile or of both racemes; the sessile spikelet of the lowest but one of the sessile raceme intermediate and imperfectly awned. Fertile spikelets linear-lanceolate, more or less acuminate, acute, including the callus 5·3-6·3 or even 7·4 mm. long, glabrous, pale green below, reddish upwards; callus short obtuse, shortly bearded. Involucral glumes equal, chartaceous, lower nerveless and shallowly concave between the acute scaberulous keels, minutely 2-denticulate, upper lanceolate-oblong in profile, acute, slightly curved on the back, 1-nerved, margins broadly hyaline upwards, ciliate. Lower floral glume linear-oblong, nerveless, hyaline, ciliolate, slightly shorter than the involucral glumes, upper very narrow, shortly 2-fid, cuneate-linear and chartaceous below the insertion of the awn, less than 3·3 mm. long, lobes broadly lanceolate, ciliate, awn up to 1 cm. long, very fine, more or less keeled at and slightly twisted below the middle; column smooth. Anthers 2 mm. long. Pedicelled spikelets male, linear-oblong, 4·2-6·3 mm. long, glabrous, more reddish than the sessile; involucral glumes subchartaceous, with 5-9 evenly distant intracarinal nerves, the upper thinner, 3-nerved; lower floral glume linear-oblong, sub-2-nerved, ciliolate, 4·2 mm. long; upper floret reduced to a male flower, or its glume present as a microscopic scale.

Locality: Sind: (Stocks 816, Woodrow); Jemadar ka Landa near Karachi (Stocks).

Distrbution: From Morocco through N. Africa, Arabia, Persia, Afghanistan, Baluchistan, Punjab, Sind.

History and Uses: See Stapf in Kew Bull. (1906), 305-313, 353.

2. **Cymbopogon Jwarancusa**, Schult. Mant. ii (1824), 458; Stapf in Kew Bull. (1906), 354; Haines Bot. Bihar and Orissa 1045.—*Andropogon Jwarancusa* Jones in Asiat. Research. iv (1795), 109; Cke. ii, 976.—*A. Jwarancusa* var.

genuinus, Hack. Monogr. Androp. 599.—*A I.* subsp. *Jwarancusa proper*, Hook. f. F. B. I. vii, 203.—*A laniger*, Duthie Fodd. Grass. N. Ind. t. 23.

Vern. Names : Jwarankusa (i.e. fever-restrainer) (Sanskr.), khavi (Hindust.)

Description : Usually a tall grass, up to 1·8 m. high, with very aromatic roots, densely tufted, the stems from clusters of firm, persistent, finally loose and open and tortuous leaf-sheaths, more or less widened below. Leaves flat, up to 60 cm. long and 5 mm. broad, narrowly linear, filiform above and ending in a long capillard tip, ligule 0 5 mm. long, membranous. Panicles long, narrow interruptey, with very compressed, short, fascicled branches bearing spathes about 5 cm. long and spatheoles 6-18 mm. long. Racemes 1 4–1·8 cm. long, often 5 joined, joints half as long as the uppermost villi. Spikelets 3–4 pairs, green, half hidden by the 5 mm. long villi, on the joints and pedicels. Sessile spikelets 5 mm. long; lower involucral glume flat or concave between the keels, which are neither winged nor margined (omitting of course, the ordinary inflexed margins of the glume common to the genus) or sometimes narrowly margined, scabrid or ciliolate, nerves 2–4 or 0 between the keels. Joints of rhachis and pedicels subclavate, with toothed tips. Pedicelled spikelets equal or rather longer than the sessile, narrowly lanceolate, purplish ; lower involucral glume 7–9 nerved.

Note.—This species is nearly related to *C. Schœnanthus* and the two, as pointed out by Hackel (l. c. p. 600), are not always distinguishable with certainty. 'At high altitudes,' says Stapf (l. c. 314), 'as in Kumaon and Spiti, or in the dryer parts of the Punjab, it (*C. Jwarancusa*) becomes dwarfed and narrow-leafed and forms a "transition state" to *C. Schœnanthus*. The latter is a characteristic desert plant, able to exist with a minimum supply of water. On the other hand, *C. Jwarancusa* is dependent on an, at least temporarily, abundant supply of water, and prefers the neighbourhood of rivers, or actually grows in the beds of torrents. It is not impossible, that the distinguishing characters of *C Jwarancusa* as compared with *C. Schœnanthus*, that is the robust state, the long, flat and relatively broad leaves, and the more composite panicles, are mainly due to eolaphic conditions.'

Locality : *Sind* : Karachi (Dalzell and Gibson); Bholari (Bhide !); Shikarpur (Bhide !); Umerkot, sandy plains (Sabnis B1082!); Gharo (Blatter and McCann D669! D670!) ; Gholamalla (Blatter and McCann D671!).—*Gujarat :* Ahmedabad (Dalzell and Gibson).

Distribution : Outer hillzone of the United Provinces, Kumaon, Garhwal (up to 3,000 m. or over) and westwards as far as Peshawar, Jodhpur and Jaisalmer States, Sind, Bihar.

Uses : Stapf is of opinion that this grass is very probably used along with *C. Schœnanthus*. See also Stapf (l. c. 313–314).

*3. **Cymbopogon citratus**, Stapf in Kew Bull. (1906), 357 in Prain Fl. Trop. Afr. ix, 282.—*Andropogon Schœnanthus*, Linn. Syst, ed. x (1759), 1304, not of Sp. Pl.; Roxb. Fl. Ind. ed. Carey and Wall. i (1820), 278.— *A. citratus* DC. Cat. Hort. Monsp. (1813), 78 ; Nees in Allgem. Gartenz. iii (1835), 266.—*A. citriodorum* (sic !) Desf. in Tabl. Ecole Bot. ii (1815), 15.—*A. Roxburghii*, Nees in Wight Cat. (1833), no. 1699 (*nomen tantum*) ; Steud Syn. Pl. Glum. i. (1855), 395—*A. ceriferus* Hack. in Mart. Fl. Bras ii, pt. iii (1883), 281.—*A. nardus*, var. *ceriferus*, Hack. Monogr. Androp. (1889), 605. *Schœnanthus amboinicum*, Rumph. Herb. Amboin. v, 181, t. 72.

For the taxonomic position of this species see Stapf in Kew Bull. (1906), 330–333.

Vern. Names : Oleu cha, hirva cha (Mar.), lili cha (Guj.), vasane-hullu, kavance hullu, majjige hullu (Canarese).

Description : A tall perennial, throwing up dense fascicles of leaves from a short, oblique annulate, sparingly branched rhizome, usually barren, but occasionally giving rise to a stout erect culm up to over 1·8 m. high, 7–8-noded and simple below the panicle. Leaf-blades linear, long-attenuated towards the base and tapering upwards to a long setaceous point, up to over 90 cm. long by 16–18 mm. wide, very firm, glaucous-green, glabrous, smooth or more or less rough upwards and along the margins ; midrib somewhat stout below, whitish on the upper side ; primary lateral nerves 4–6 on each side, raised particularly above with 2–4 secondary nerves between them. Ligules very short, scarious, rounded or truncate. Sheaths terete, those of the barren shoots much widened at the base, and tightly clasping each other, narrow and separating upwards, with rounded shoulders at the mouth, 10–30 cm. long, subcoriaceous, quite glabrous and smooth, more or less cinnamon-coloured or russet on the inside ; sheath of the culms tight, shorter than the internodes, finely pubescent or velvety at the nodes. Spatheate panicle decompound to subdecompound, loose, 30 to over 60 cm. long, nodding ; internodes 4 to over 6, the longest up to 20 or 22 cm. long, rapidly, decreasing in length upwards ; lowest primary branches undivided at the base, up to over 45 cm. long, and up to 5- or 6-noded, the following forming mixed tiers of very unequal variously compound and simple rays, ultimate tiers up to 4-rayed ; rays filiform and glabrous; spathes narrow-lanceolate, acute or acuminate, 2·5–5 cm. long with narrow membranous margins. Spatheoles very narrow, linear-lanceolate to almost subulate when inrolled, 14–18 mm. long, acute or finely acuminate, reddish to rich russet. Peduncles 6–10 mm. long, glabrous. Racemes 2-nate, finally spreading at right angles or epinastically deflexed, moderately dense, 14–25 mm. long, pale, variously tinged with dull purple, loosely villous, one subsessile, the other with a slender filiform bare base, almost 2 mm. long and hairy, the pedicel of the homogamous pair also slender, though short ; fertile joints filiform, slender, 2–3 mm. long, ciliate on both sides, tips obliquely auriculate and cupular, adjacent pedicels very similar. Homogamous pair of spikelets 1 at the base of the sessile raceme, its sessile member usually slightly differing in shape from the fertile spikelets. Fertile spikelets linear to linear-lanceolate, acutely acuminate, 5–6 mm. long, reddish, glabrous; callus short, obtuse, minutely bearded. Involucral glumes subequal, lower subchartaceous, slightly depressed towards the base, otherwise flat on the back, keels acute, scaberulous above, intracarinal nerves 0 or 1, short or indistinct, upper boat-shaped, slightly curved on the back, acute, keeled upwards. Lower floral glume hyaline, linear-oblong or almost linear, sub-2-nerved, ciliolate above, slightly shorter than the involucral glumes, upper narrowly linear, acute, about 4 mm. long, usually entire and awnless, rarely more or less 2-fid with a small bristle from the sinus. Anthers 2 mm. long. Pedicelled spikelets male or neuter, linear to subulate-lanceolate, as long as the sessile, reddish, glabrous; lower involucral glume 5–9-nerved, upper 3-nerved; lower floral glume shorter to much shorter than the involucral glumes, hyaline, ciliolate, upper very narrowly linear, nerveless if present at all.

Locality : Gardens in Bombay.

Distribution : This grass is only known in the cultivated state. Probably of Indian origin, and now widely distributed over the tropics of both hemispheres. See Stapf in Kew Bull. (1906), 334.

History and uses of the Lemon-grass : Stapf l.c. 322–330. 334, 358.

4. **Cymbopogon Martini,** Stapf in Kew Bull. (1906), 359 ; Haines Bot. Bihar and Orissa 1046.—*C. Martinianus*, Schult. Mant. ii (1824), 459.—*Andropogon Martini*, Roxb. Fl. Ind. i (1820), 280.—*A. pachnodes*, Trin. in Mem. Acad. Petersb. ser. 6, ii (1833), 284. and Spec. Gram. Ic. (1836), tab. 327.—*A. Calamus aromaticus*, Royle, Essay Antiq. Hind. Med. (1837), 33 (*nomen tantum*), Illustr. Bot. Himal. (1840), tab. 280.—*A. nardoides, α* Nees, Fl. Afr. Austr. (1841), 116. —*A. Schœnanthus*, Fluck. and Hanb. Pharmacogr. (1874), 660 (*non* Linn.)—*A. Schœnanthus*, var. *genuinus*, Hack. Monogr. Androp. (1889), 609 (*partim*). —*A. Schœnanthus*, var. *Martini*, Hook. f. in F. B. I. vii (1897), 204 (*exclus. synon. referentibus ad plantas Africanas*).—For the foundation of this species and its synonymy see Stapf in Kew Bull. (1906), 335–337.

Vern. Names : Geranium grass, Rusa grass ; rohisha, rosem (Sanskr.) ; rusa, gandh-bel, mirchia gandh, tikhari (Hindust.) : rohish, roshegavat (Mar.) ; rhonse, rauns (Guj.) ; eunthi hullu, khasi hullu (Kanar.).

Description : A tall, perennial, sweet-scented grass, 1·5–2·4 m. high. Stems glabrous, straw-coloured, leafy. Leaves flat, usually broad, rounded or subcordate at the base, more or less glaucous beneath, those below the inflorescence rarely under 23 cm. long by 1 cm. wide at the base, but often 2·5 cm. wide below, tapering from a little above the base or from the middle to a firm tip, glabrous except for the scabrid margins, margin sometimes smooth near the base. Spikes 2-nate, 12–18 mm. long, oblique or divaricate or less often deflexed. Peduncle about half the length of the 18–25 mm. long spatheole, several spatheoles and their peduncles from a spathe of lower order, these arranged in long usually narrowly oblong panicles not more than 3·5–5 cm. wide, but sometimes panicle with many branches and broader. Joints and pedicels slenderly clavate (excluding the much thickened lowest), about half as long as the sessile spikelets, tips with a lanceolate tooth or 3-toothed, margins long-villous, 3·5–5 mm. long. Lower involucral glume (above the lowest spikelet) with lanceolate centre becoming oblanceolate or oblong from the keels being membranously winged above the middle, back with a vertical median depression below the middle corresponding to a ridge inside ; upper cymbiform with the dorsal keel winged above, minutely ciliate below.

Locality : Gujarat : Champanir (Chibber !) ; Ahmedabad, dry hills (Sedgwick 310 !) : Junagad, Kathiawar (Blatter 3783 !) ; Bhuj-Rhodir-Maha, Cutch (Blatter 3649 !) ; Anjar, Cutch (Blatter 3741 !).—*Khandesh* : Road to Chinchpada (Chibber !) ; Toranmal (McCann A235 !).—*Konkan* : Wada Range (Ryan 488 !) ; Gokhirva, Bassein (Ryan 41 !) ; Keltan (Ryan 392 !) ; St. Xavier's College compound (McCann 4461 !).—*Deccan* : Ganeshkhind Botanic Gardens (Garade 435 !) ; Purandhar (Bhide !) ; Pashan (Gammie !) ; Modasa (Sedgwick and Saxton !) ; Khandala, very common (McCann !) ; Igatpuri (Blatter and Hallberg 4432 !) ; Purandhar (McCann 5010 !) ; Kasara, Igatpuri Ghat (McCann 4343A !) ; Panchgani (Blatter and Hallberg B1248 !, B1282 !, B1297 !, B1324 !).—*S. M.Country* : Haveri (Talbot 2180 !) ; Dharwar (Talbot 2616 !) ; Badami (Talbot 2928 !). [According to Malcolmson, ' the Rusa grass in the Deccan affects particularly the trap, more or less avoiding the granite, so much so that he was able to trace the green-stone dykes across the granite by the luxuriance of the grass ' (ex Stapf)].

Distribution : From the Afghan frontier to the Rajmahal Hills in Bengal and from the subtropical zone of the Himalaya to about 12° N., excluding the desert region of the Punjab and the greater part of the northern Carnatic.

Stapf excludes also the outer slopes of the Western Ghats, but the localities given above show that the grass is well represented in that region. For the history and uses of the Rusa grass oil *Oleum Palmarosæ seu Geranii Indici* (Palmarosa oil) see Stapf in Kew Bull. (1906), 338–341, 360.

5. **Cymbopogon caesius,** Stapf in Kew Bull. (1906), 360. in Prain Fl. Trop. Afr. ix, 287.—*Andropogon caseius*, Nees in Wight. Cat. (1833) nos. 1700b (*nomen tantum*) and in Hook. and Arn. Bot. Beech. Voy. 244 *cum descriptione* (*partim*).—*A. Schœnanthus*, var. *caesius*, Hack. in Monogr. Androp. 610 ; Schweinf. in Bull. Herb. Boiss. ii, App. ii, 14 ; Hook. f. in F.B.I. 205, *exlus. fere omnibus synon.*

For foundation of this species see Stapf in Kew Bull. (1906), 344.

Description : A perennial, tufted grass, up to 1 m. high, with intra— and extravaginal innovation-shoots from a short rhizome. Culms erect or geniculate-ascending, slender, more or less wiry, frequently branched below, the branches often in fascicles from the knees, often many-noded, terete, glabrous, smooth. Leaf-blades linear from a scarcely narrowed rarely slightly rounded base, tapering to a long setaceous point, those of the culms up to over 15 (sometimes almost 30) cm. long, 2–6 (sometimes 10) mm. broad, of the innovations usually much shorter, flat, bluish-glaucous, glabrous, smooth, midrib slender, primary lateral nerves very fine, 3–4 on each side. Ligules very short, rounded, scarious. Sheaths rather firm, tight, the lowest mostly short, those placed at branching nodes at length thrown aside, inrolling or deciduous, glabrous, smooth, usually much shorter than the internodes. Spathaceous panicle narrow, mostly 7–15 cm. long, rarely much longer, sometimes reduced and small, dense or interrupted ; internodes usually 4–6, the lowest rarely exceeding a third of the panicle, the following gradually decreasing ; lowest primary branch shortly exserted from its sheath, undivided at the base, or like the following forming mixed or (upwards) simple-rayed tiers ; rays of ultimate tiers 5–3, finely filiform. 7–10 cm. long, glabrous ; lowest subtending sheaths with foliaceous blades : spathes lanceolate, acuminate—2·5—4 cm. long, subherbaceous, glaucous, sometimes turning reddish. Spatheoles narrowly lanceolate, acuminate, 14–16 mm. long, subherbaceous to scarious, turning dirty straw-colour or slightly reddish ; peduncles filiform 5-6 mm. long, glabrous. Racemes 2-nate, obliqualy erect. 12–14 mm. long, greenish, more or less white-villous, one subsessile, the other with a bare base, over 2 mm. long, finely pubescent on the inner side, ciliate and thickened upwards, base of the subsessile raceme swollen, hard, fused with the equally swollen and hard adjacent pedicel ; fertile joints filiform, about 2 mm. long, glabrous on the back, densely ciliate on the sides, cilia snow-white, tips often cupular with a crenulate margin or auricle ; adjacent pedicels very similar. Homogamous pair 1 at the base of the sessile raceme. Fertile spikelets oblong, slightly wider above the middle, subobtuse, 4 mm. long, greenish, glabrous ; callus very small, obtuse, minutely bearded. Involucral glumes equal, subchartaceous, lower minutely truncate, flat on the back with a fine median grove in the lower half, keels narrowly winged from the middle upwards, intracarinal nerves 1 on each side towards the keels, very fine ; upper narrow in profile, very acute, very narrowly winged above the middle with 1 delicate nerve on each side near the margin. Lower floral glume delicate, oblong, minutely truncate, ciliolate, nerveless, upper substipitiform, almost 3 mm long, 2-fid to the middle, segments subulate, ciliolate, awn very fine, 10–14 mm. long, bent at and twisted below the middle. Anthers almost 2 mm. long. Pedicelled spikelets male, linear to lanceolate-oblong, subobtuse, 4 mm. long, green, glabrous ; lower involucral glume slightly convex on the back, subherbaceous, about 10-nerved, the inner 6 nerves prominent, upper subhyaline, 3-nerved ; floral glume oblong, truncate, sub-2-nerved, almost 4 mm. long.

Locality : Gujarat : On sandy and gravelly hills and banks, Ahmedabad and Prantij.

Distribution : Throughout the Carnatic, Gujarat, Arabia, Somaliland.

For *history* and *uses* see Stapf Kew Bull. (1906), 342–345, 361.

(*To be continued*)

THE HOME OF THE EASTERN GORILLA

BY

MARIUS MAXWELL,

Author of 'Big Game Hunting with a Camera in Equatorial Africa'
(*With a map and ten plates*)

INTRODUCTION

Intending to visit a portion of the Eastern Congo and in particular the Birunga (Virunga) mountains, I left Nairobi with my companion, Mr. James Hugh Barnes, on February 11, 1925, and travelled by motor car across Uganda. We joined our porters at Kabale, a few days' march from the border of the Belgian Congo, and proceeded to Behungi (altitude 8,214 feet). From this spot, situated on the eastern wall of the great Central Depression, we enjoyed a splendid view over an extensive stretch of craterland, partly on the border-line of Western Uganda and partly in the adjoining territory of the Congo. We also gained our first view of the magnificent chain of mountains known as the Birunga volcanoes. These mountains have long been known to form the main habitat of the Birunga Gorilla[1] (*Gorilla beringeri*), named after Oscar von Beringe, who discovered the species in 1903. This is a very different animal from the lowland gorilla found in other parts of the Congo and West Africa, a young specimen of which could at one time be seen in the Zoological Gardens in Regent's Park. The Kivu, Birunga, or Eastern Gorilla is a much finer creature, the adult male being particularly impressive in appearance. The West African Gorilla differs from the Birunga Gorilla in many respects, the hair, for instance, on the head and body being considerably shorter in the Western form.

Our object was not only to acquaint ourselves with the home of this comparatively little known ape, but also to study its habits more closely. Incidentally, I wished to take a few snapshots of the animal in its native surroundings. In accordance with these intentions, over a month was spent on several of these volcanoes, with an aneroid barometer and a hand-camera as our chief equipment.

GEOGRAPHY OF THE BIRUNGA MOUNTAINS

It may perhaps be as well to preface this account of my experience with a brief description of the geographical position and the physical aspect of these mountains. This introduction, illustrated with a few photographs, may help to establish a better understanding of the habitat of the Birunga Gorilla. (See Map.)

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[1] Also known as the Eastern or Mountain Gorilla.

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(PROVISIONAL ISSUE)

MUFUMBIRO

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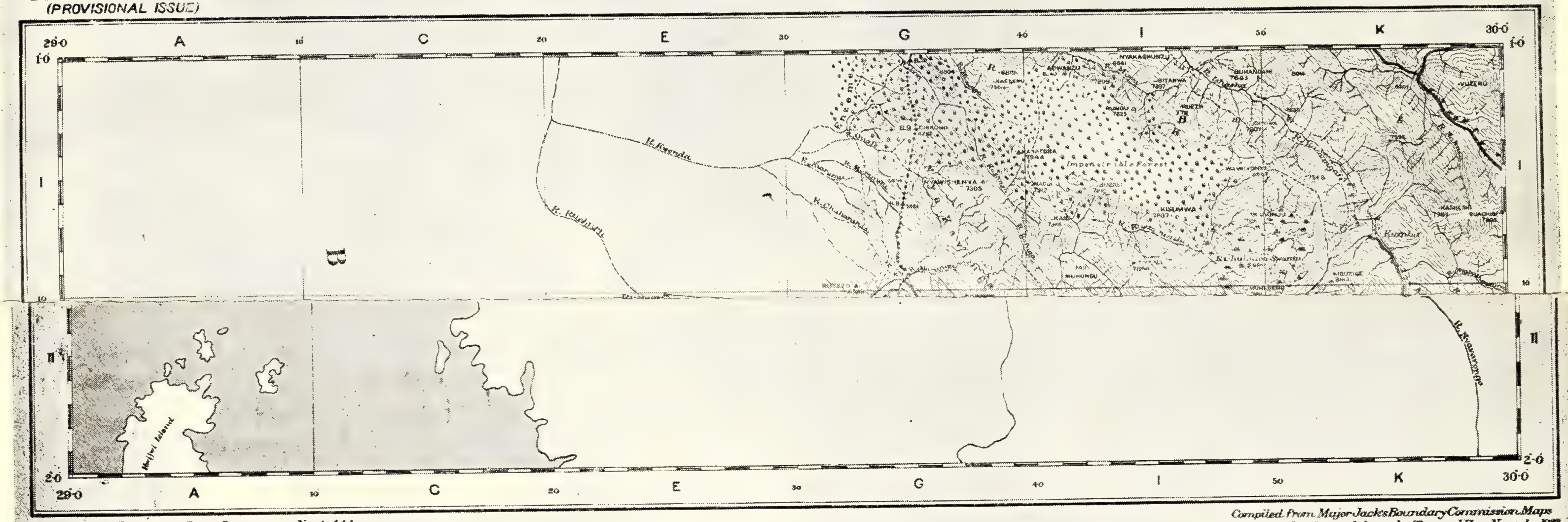
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NIBUZINE
RUZIZO
Kuruka
R. Nyavarongo
Idjwi Island

Uganda Protectorate Survey Department. No. A. 444
E. Richardson, Director of Surveys

Compiled from Major Jack's Boundary Commission Maps & various sketches and drawn by Shamsul-Huq. November 1922.

Ordnance Survey 1923

Scale 4 Miles to 1·014 Inches

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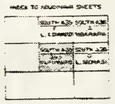
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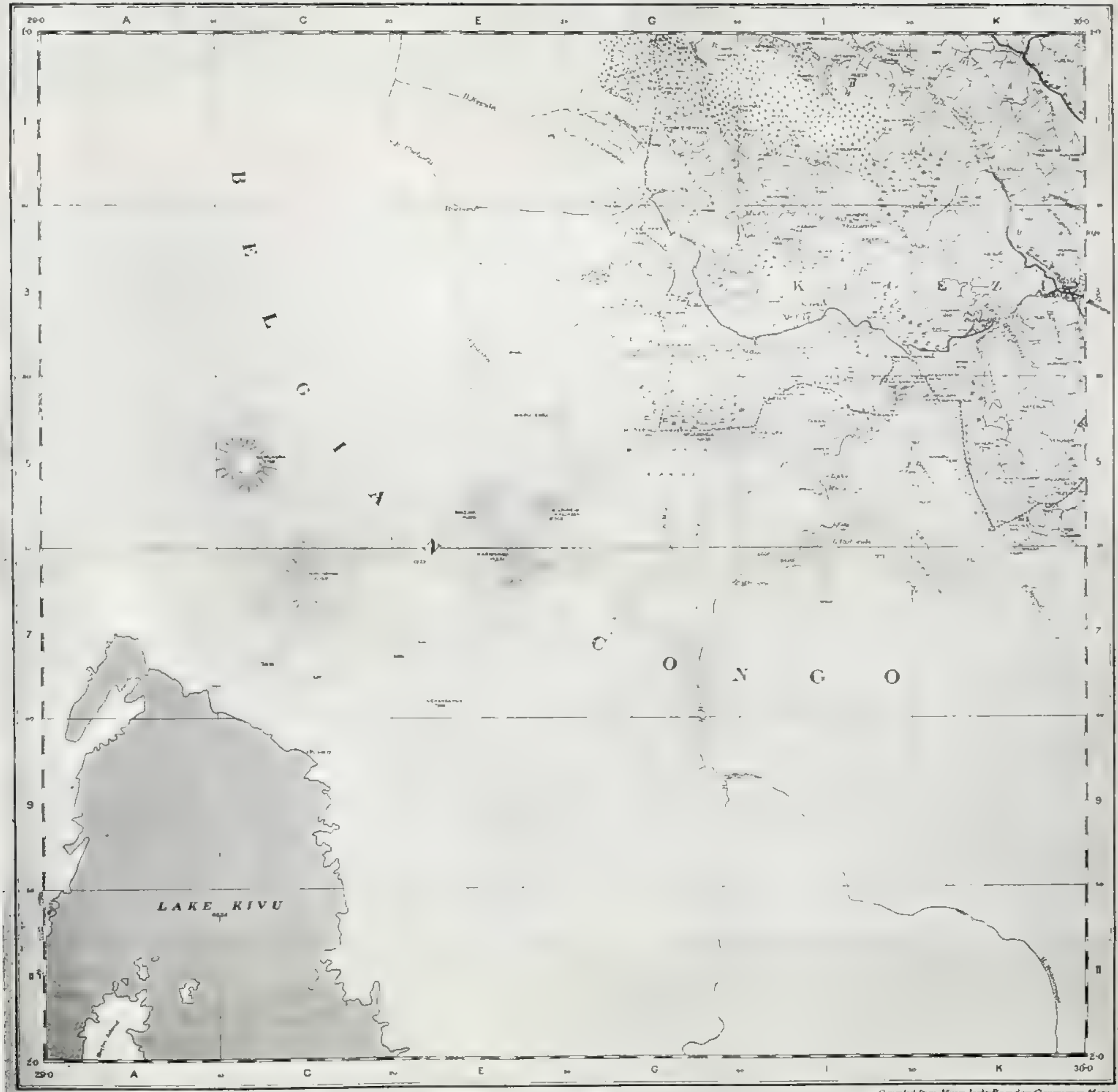

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Uganda Protectorate Survey Department. No. A. 444
E. Richardson Director of Surveys

Compiled from Major Jack's Boundary Commission Maps & various sketches and drawn by [illegible] November 1912.

Ordnance Survey 1915

Scale 4 Miles to 1·0 Inches

Miles 5 4 3 2 1 0 5 10 15 Miles
Kilometres 5 4 3 2 1 0 5 10 15 20 25 Kilometres

1 Centimetre to 2·5 Kilometres

No. 1. Mt. Mgahinga (11,400 ft.) with Mt. Muhavura (13,547 ft.) in the background.
(*See Explanation of Plates.*)

No. 2. Mr. James Hugh Barnes, the writer's companion, with the Porters. The precipitous peaks of Sabinio in the background.
(*See Explanation of Plates.*)

The Birunga Mountains proper, as the map indicates, are situated to the north-east of Lake Kivu, and present, with the eight main volcanoes, an imposing chain. This chain runs in a somewhat south-westerly direction, almost at right angles across the main depression or Central Rift, and roughly speaking separates the basin of the Congo River from that of the Nile. At their base, and extending over a large tract of country to the north as well as to the south of these volcanoes, can be distinguished a multitude of small, extinct craters overgrown with grass. These form a veritable 'craterland', and appear, when viewed from a great elevation dotted like hillocks about the floor of this great depression. Incidentally it may be observed that so much progress has been made of late years in the development of the Congo that the locality is now easy of access.

The eight main volcanoes of the Birunga range to which reference has just been made, are taking them in order from east to west :—

1. Muhavura, with an almost perfect regularity in shape, and a summit rising to a height[1] of 13,547 feet above sea-level.
2. Mgahinga, a truncated cone with slightly concave sides and a height of 11,400 feet.
3. Sabinio, with its array of jagged and precipitous peaks, and deeply furrowed slopes, attains a height of 11,960 feet.
4. Visoke, a truncated cone with almost straight sides, has a height of 12,568 feet.
5. Karisimbi, with its unpretentious flat cone, is the highest mountain in the whole range and reaches an altitude of 14,633 feet.
6. Mikeno, a massive mound with a rocky summit, as may be seen from the illustration, is perhaps the most favoured home of the Kivu or Mountain Gorilla, which is known by the local name of *Ngâghi* (pronounced *Engâghi*). Mikeno has a height of 14,385 feet.

Then follow the most westerly craters, Niragongo (11,250 feet) and Namlagira, the lowest mountain of the whole range, with a height of 9,766 feet. Niragongo and Namlagira stand side by side together, but detached from the other six. The last two volcanoes are at present the only ones that are still active. Niragongo appears to be dying out.

The first six volcanoes can be divided into two distinct groups connected by a long and comparatively low saddle, roughly eight miles long, densely wooded, mainly with bamboo and tropical undergrowth.

The eastern group consists of Muhavura, Mgahinga and Sabinio, which stand closely side by side in a line running approximately from east to west. They form the present boundary between a corner of Western Uganda and the mandated territory known as Ruanda (Belgian occupation). Sabinio stands on the boundary of Uganda and the Belgian Congo.

The second group, consisting of Visoke, Karisimbi and Mikeno, is situated in Congo Territory, and the three volcanoes are situated roughly at the corners of an isosceles triangle. The saddle, mentioned just now, connects Sabinio of the first group with Visoke in the second group.

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[1] The heights of the various volcanoes are taken from the Boundary Commission Maps, 1923. (Provisional Issue) Sheet $\frac{\text{South A. 35}}{\text{L}}$.

These splendid mountains rise from the level of the highland plains which are already from 5,000 to 6,000 feet above sea-level. On a clear day they form a commanding array visible for many miles around.

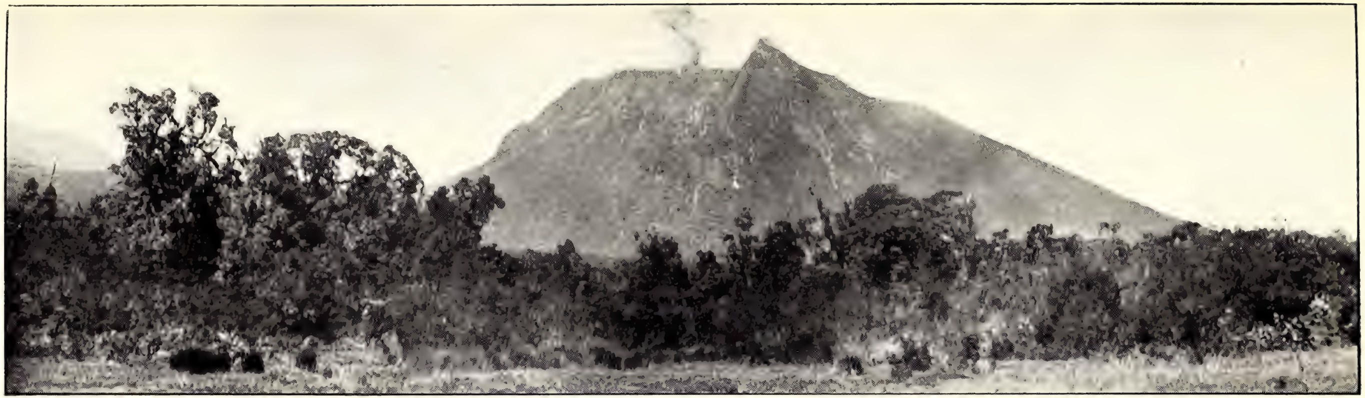
It is locally known that the Birunga Gorilla, or as the natives call it, *Ngâghi*, occurs in both the Sabinio and Mikeno groups of volcanoes. The latter, however, is the more favoured habitat. There can be no doubt that an occasional migration may take place from the one group of mountains to the other, since the gorillas can wander across the densely forested saddle between Visoke and Sabinio without having to pass through inhabited valleys or plains. There can therefore be no question of local distinctions between the gorillas living in the two groups of mountains. Although it is not improbable that these apes occasionally frequent the two most westerly volcanoes Nirangongo and Namlagira, their presence there is apparently, not so common that these volcanoes can be regarded as permanent habitats.

The shooting of these great apes is now prohibited by the Congo Government under penalty. Although the Birunga volcanoes have recently, in 1924, been declared a closed sanctuary for gorillas, the provincial Commissioner of the Kivu District, M. Ernest Ledocte, very kindly allowed Mr. J. H. Barnes and myself to enter the reserve, on condition that we would avoid killing any of the gorillas, a condition we willingly accepted.

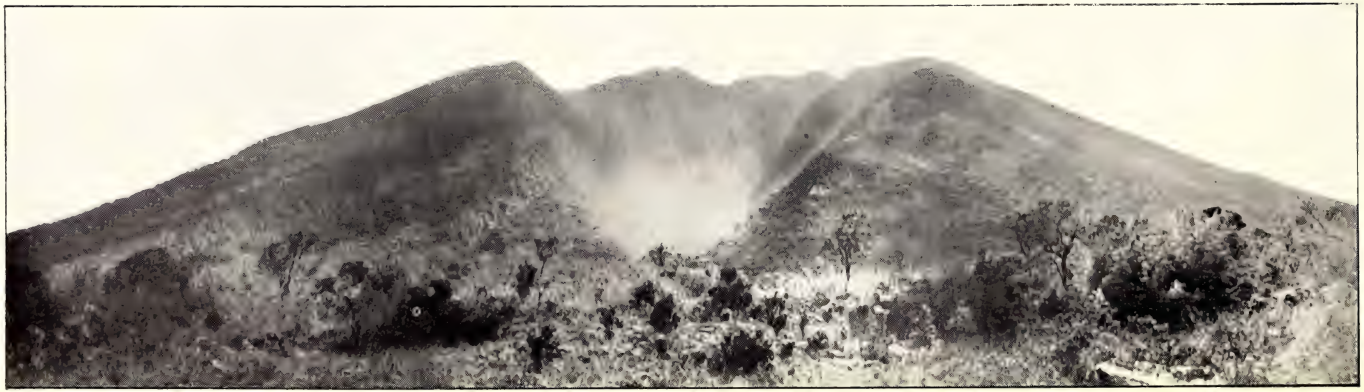
The absence of successful photographs showing the Birunga Gorilla in its native forests is due mainly to the following causes: Their normal habitat on these mountains lies at an altitude of between 7,000 and 12,000 feet and they live among the densely carpeted slopes, or in the thick bamboo forests, and the wooded ravines and kloofs, where the light conditions are mostly too unfavourable to allow for an instantaneous exposure. These equatorial mountain regions have in general a humid and mist-laden atmosphere, especially in the higher zones, above, say, 9,000 feet altitude. In these increased altitudes, the slopes and crags are more frequently than not enveloped in mist, with the peaks and the summits shrouded in dense clouds, or they are exposed to rains, varying from a cold continuous drizzle, with heavy showers at intervals, to a pelting tropical tornado and occasional hailstorms.

Secondly, the gorilla is averse to showing itself to human beings. Its tendency is to shun observation and, if its privacy is invaded, it retires into the densest parts of the forest undergrowth, offering little opportunity for what can only be a hurried snapshot, even with reasonable light conditions.

The vegetation on these Birunga volcanoes, especially on Mikeno and Karisimbi, can be roughly divided into three distinct zones. The lower belt, say from approximately 7,000 to 9,000 feet, consists of bamboo forests and large trees with dense undergrowth. Tangles of lianas and a variety of creeping plants hang in curtains or festoons from the tree stems or from the lofty



No. 3. Panoramic View of Mt. Mikeno (14,385 ft.) and Mt. Karisimbi on the left (14,633 ft.)
(*See Explanation of Plates.*)



No. 4. Panoramic View of Mt. Sabinio.
(*See Explanation of Plates.*)

No. 5. A Typical Forest of Mikeno (alt. about 11,000 ft.), showing Hagenia trees in tall undergrowth.
(*See Explanation of Plates.*)

No. 6. Another Forest Scene on Mt. Mikeno at 11,000 ft. alt., showing a portion frequented by Gorillas.

branches. In short, the scenery of this zone presents in many places the primeval nature of a typical Congo Forest as it is so often depicted in illustration.

The intermediate zone, say from 9,000 to about 12,000 feet altitude, as typified by the vegetation of Karisimbi and Mikeno, consists in the main of a vast undulating carpet of a chervil-like plant and stinging nettles, interspersed with giant lobelias, docks, sorrels, hemlocks and similar plants. Stately, broad-crowned Hagenia trees (*Hagenia abyssinica*) rise from among this dense undergrowth at such distances that in many places their crowns touch one another. They form, as it were, a roof that covers the undergrowth at a height of twenty-five to thirty feet from the ground, while transmitting a certain amount of light, so that the mountainous landscape below the trees remains in moderate gloom. These Hagenia trees, as may be noticed in the photographs, have mostly short, thick stems with here and there very widely diverging branches of great size. Some of these, especially the broken and decaying branches, are heavily overhung with a variety of vines and creepers and carry massive pads of rank moss and lichens. The base of the stems of old trees frequently reach a circumference of fifteen feet; their roots are exposed and are often hollowed at the base. Curtained as they are with trellises of luxuriant creepers, they form niches serving as snug resting-places and night-shelters for the gorillas of these regions. The cautious stalker, if he is fortunate, may occasionally find a gorilla peering out at him from among such thickets. Owing to the height of the surrounding vegetation, the animals are able to enter or leave these shelters without being observed. The crevices and rents of these trees constitute the favourite home of the mountain Hyrax, a small beast like a marmot in appearance, which utters a peculiar cry.

The highest zone, commencing at an altitude of approximately 12,000 feet, shows an equatorial subalpine and alpine flora beginning with patches of Giant Heath (*Erica arborea*), the stems being frequently covered with a ragged beard moss, which hangs in places in long grey-green shreds. The height which these tree heaths can reach is shown in the accompanying photograph. The foliage varies in colour from heather and dark brown to a light brown or deep red. The giant heaths appear to grow best on shallow surface soil resting upon the rugged volcanic rocks. The rock is here and there covered with great golden patches of moss or exposed in scored and precipitous patches with glistening streaks of moisture trickling from the sodden slopes and mountain ledges above. Where the layer of soil is too thin to furnish sufficient hold to the roots of these giant heaths, the heavy trees topple over. These fallen trees, enveloped as they are in thick beard moss and lichens present a curiously dismal conglomeration of dying and decaying alpine vegetation. Higher up, the lobelias with their tall poker-like tops and the giant groundsels (*Senecio johnstoni*) are the most dominant features of the flora. In the highest regions the ground is covered with Alchemillas and thick drab moss.

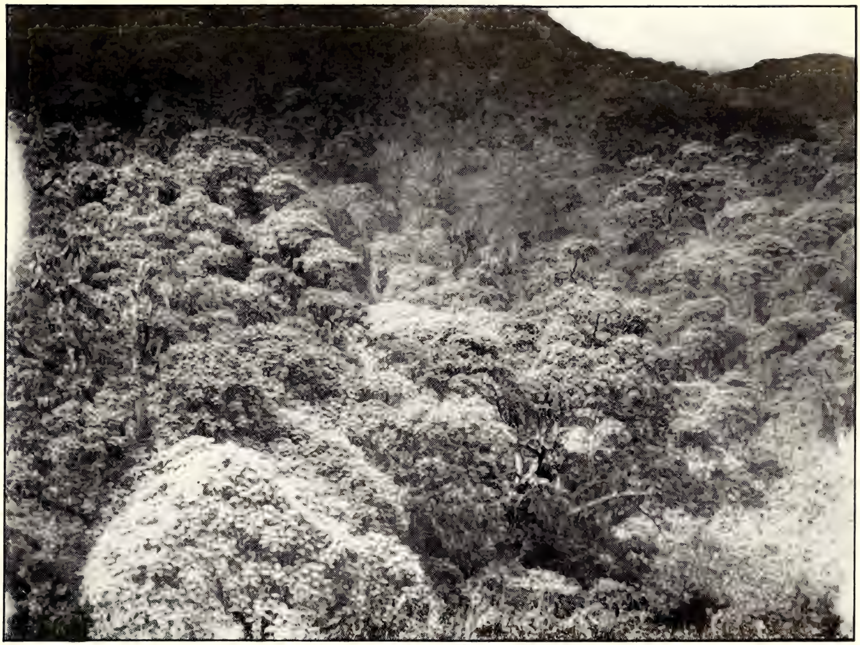
After these remarks upon the local conditions, we will proceed to discuss the habits of the gorilla itself.

GENERAL HABITS OF THE BIRUNGA GORILLA

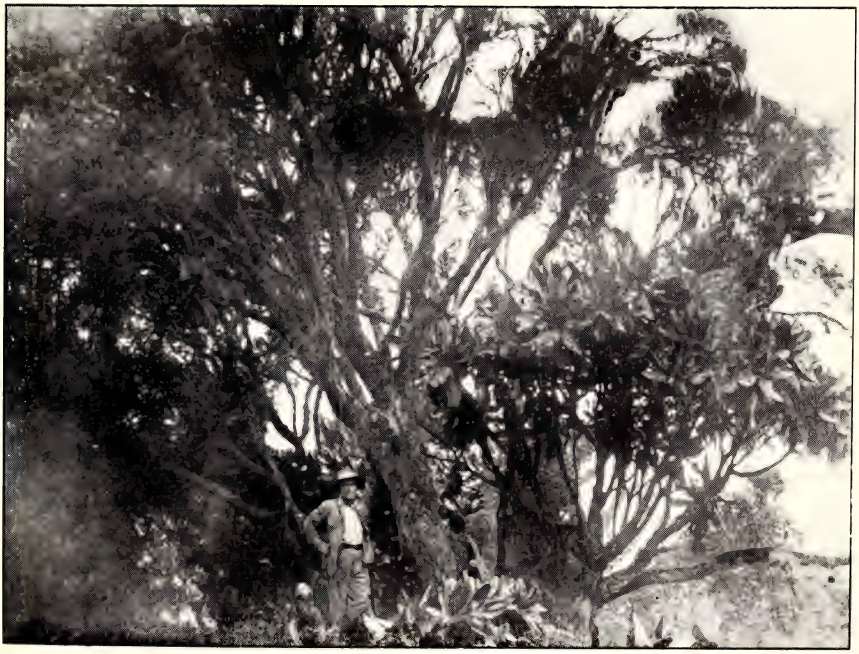
In disposition, these apes are normally neither ferocious, nor aggressive, nor do they even appear to be quarrelsome among themselves. They naturally resent being suddenly and unexpectedly interfered with while dozing, or feeding in their secluded retreat. Except under such provocation the beast is decidedly of a retiring nature, and takes care to avoid human observation. On the other hand it may well be imagined that the gorilla offers in its appropriate mountain wilds an aspect quite different from that presented by an occasional immature specimen of the West African lowland gorilla in captivity. In the former case, it is generally met with in circumstances and surroundings that are apt to excite the imagination of the pursuer, especially after he has read the various stories of their ferocity and other alleged undesirable traits. On close acquaintance with this inoffensive inhabitant of these altitudes, it will be found that the gorilla differs in mentality very little from the other apes. A more profound study of the animals does, however, show that certain primitive human instincts exist in these anthropoids. On the other hand, it should be emphasized that there is no suggestion of any skilled movements ; the idea of these apes employing, in their wild state, sticks or stones as means of defence or offence, would strike an observer, even after a most preliminary acquaintance, as far from correct. Nature has provided these large apes, especially the old males, with ample means for safeguarding themselves against the attacks of carnivora. An occasional young one may fall a victim to the leopard, traces of which animal are fairly common in these regions, occurring even up to an altitude of 13,000 feet. The lion is not included in the fauna associated with the gorilla of the Birunga volcanoes.

The first glimpse of a gorilla in the more open parts of the Hagenia and 'wild-chervil' forests is as a rule the appearance of a large, jet-black and shaggy head set on a pair of disproportionately broad and square shoulders. Although the normal gait of the gorilla is ostensibly not that of a biped, but that of a quadruped, it frequently and unconsciously retains the erect posture. It may on occasion be seen standing, or wading through the green vegetation, moving at intervals for a few steps in an erect attitude, and reaching out for some attractive stalk. In its erect gait the gorilla stoops forward perceptibly and shows in profile the back of its shaggy head in a straight line with its somewhat inclined back. Gorillas squat about a good deal, and show a variety of comical poses, especially when picking at the soft bark of the chervil-like plants. They consume the pith of these plants, which, in certain regions appears to constitute their main diet.

Curiosity will, as a rule, prompt them to stand erect on their short, bandy legs for quite a long time and peer intently at the intruder ; in such cases, however, they rarely show more than their head and shoulders, above the vegetation. The countenance of this ape, when its curiosity only is aroused, bears a most peaceful expression. The neck being very short and massive, the head is in consequence held somewhat rigidly. When scared or pursued



No. 7. A Forest of *Hagenia abyssinica* on Mt. Mikeno at an altitude of over 9,000 ft.
(*See Explanation of Plates*).



No. 8. Arboreal Heath (*Erica arborea*) and Senecio, a Giant Groundsel (*Senecio johnstoni*). Note their respective heights by comparison with the figure below the trees.

No. 9. The summit of Mt. Mikeno (14,385 ft.), showing alpine vegetation on the slopes of the peak.

(*See Explanation of Plates.*)

No. 10. A startled Female Gorilla (marked with cross in foreground) making off with her young on her back.

(*See Explanation of Plates*).

the gorilla does not take to the trees, but prefers to move silently off on all fours through the dense under-vegetation, shunning observation as much as the surroundings will permit. It is quickly out of sight, and a fleeting glimpse of its head and sloping back is all that is presented to the observer. The arms being very long in proportion to the bowed legs, it goes without saying that the body stoops less during locomotion than it does with other apes. The forepart of the body is supported by the knuckles of the hands placed on the ground. The adjoining photograph shows a startled mother-gorilla in the act of escaping with her progeny seated like a jockey and clinging to her back. I took this snapshot at a moment when the animal mounted an obstruction across her path. She was thus for an instant exposed to the camera, before disappearing in the thick, yielding undergrowth. The attitude here depicted is evidently the way they carry their infants when they are prompted to move hurriedly through the dense ground vegetation. At other times the young one may be seen encircling with its arms the neck of the seated parent, sometimes with its little feet clinging to the shaggy hair of its mother.

On the right of this picture, somewhat indistinctly, about half-way up the mountain-slope, is a sub-adult gorilla in an agitated condition and standing up among the dense forest undergrowth and exposed to its waist. The circumstances were briefly these: I happened to come suddenly upon a party of the feeding creatures. Startled by my appearance, they uttered their discordant shrill and reiterated cry of excitement previous to a hurried departure. The younger members are, on such occasions, apt to show their resentment, or terror, by antics as well as by shrill cries, thus occasionally giving the stalker time to take a hurried snapshot of his subject. It will be noticed that the mist-laden atmosphere has somewhat interfered with the clarity of the photograph, but in the circumstances it was all that the lens could be expected to give.

Differences of Sex and Age

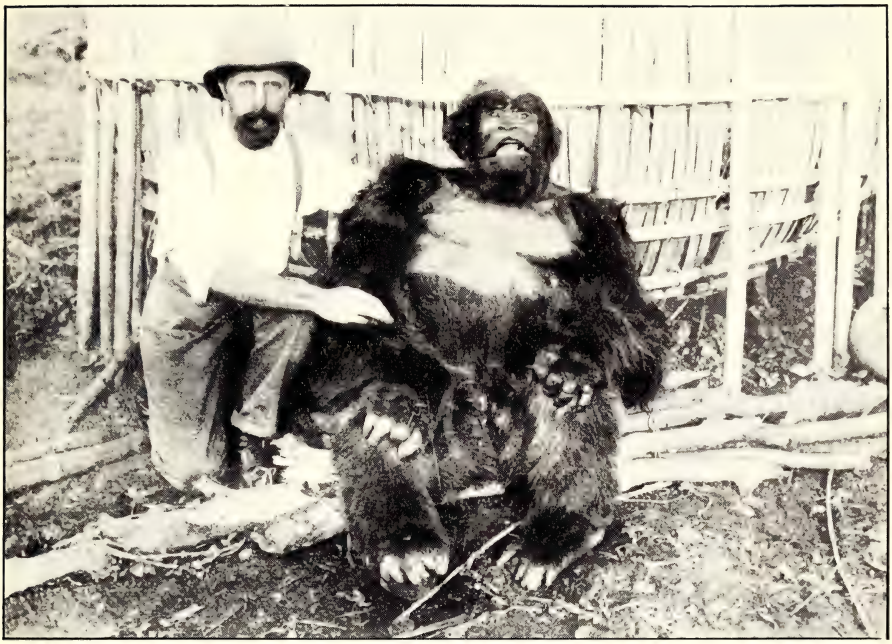
The sexual differences in these apes are considerable. Whereas the female gorilla, which is in build and height much inferior to that of the male, invariably makes off with the stoop in the case of a disturbance, the old male of the family will, at close range, behave quite differently. The bull gorilla of the party, usually a very fine and powerful creature is on such occasions apt to give a display of his violent resentment at the sudden intrusion. The resentment is exhibited, first by a quick approach on all fours, to the accompaniment of a sharp, abrupt and reiterated sound, something between a grunt and a bark, followed by an impressive advance in an erect posture, accompanied by a quick succession of discordant screams not unlike the noises of a pig as it finds its way to the slaughter-house. The suddenness, and the fact that these demonstrations are generally carried out at uncomfortably close range, in unexpected and awkward thickets, leaves one baffled for the moment. In the cases experienced we found that once it has expended the effect of its bluff and realized that its menacing approaches are of no avail in driving the stranger away, it turns promptly and joins the departing family group. The grotesque appearance, at close quarters, of the stocky, bowlegged creature, advancing at a toddle in an erect attitude is impressive ; with its scalp drawn down and thus bristling its hairy crest it is a sight enough to scare any wild creature of the forest. With the mouth open and the retracted lips exposing the canines at each expiration, the irritated animal then undoubtedly gives a pronounced appearance of ferocity. He approaches the intruder rapidly in his stooping attitude, on all fours, and only rises on his feet at a few yards from his adversary. The environment is usually such that it increases the effect of the sudden appearance from the undergrowth of the great shaggy head and broad shoulders. I have not seen gorillas beat their chest in such circumstances ; and I am not aware that they ever do so when in movement, as their arms then seem instinctively inclined to take advantage of any support. The noise produced by thumping on the body is occasionally heard coming from adult members of a party, and is in the absence of intruders, presumably purely an expression of exuberant spirits.

At a distance the old male may beat his chest in mild defiance of an intruder, but the performance is, I have noticed, usually carried out from some covert or in thickets where the creature imagines himself concealed from observation. The performance becomes sometimes ludicrous.

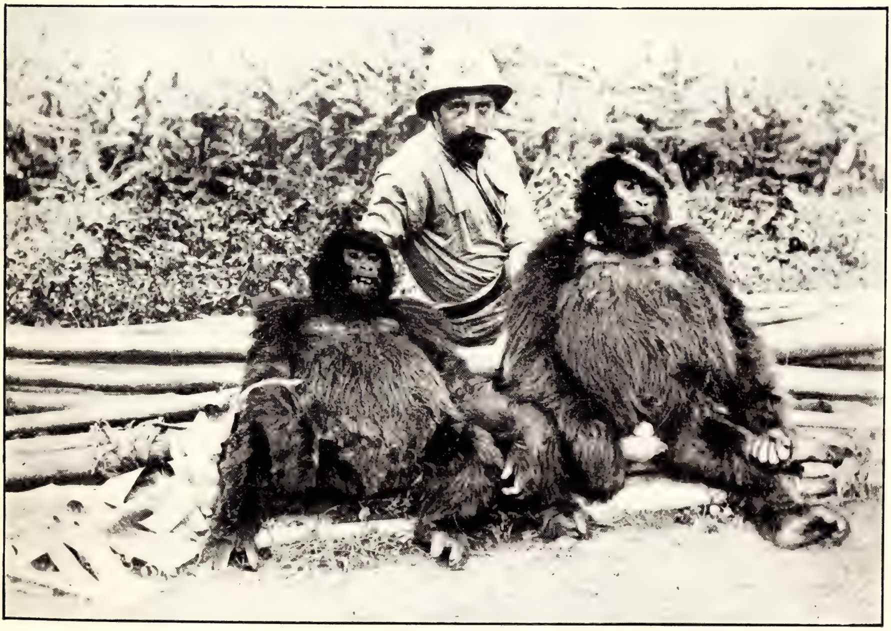
Whereas the tautly paunched belly in the male is covered with hair (as the adjoining photograph of gorilla clearly shows), the chest is bare and wrinkled, attaining with age a marked flabbiness ; the armpits are likewise bare. The sound of the beating on this part of its anatomy is in the case of an old male nothing more formidable than that which a portly person can produce by the loud and repeated thumping of his naked chest with either the palm of his hand or with the closed fist ; the Kivu Gorilla appears to produce both these sounds. The impressive forest-environment and the silence which reigns over these man-forsaken regions has no doubt much to do with the elaborate descriptions of these quite natural sounds.

The females are insignificant in appearance as compared to the adult male, and are known to be from a foot to about a foot and a half shorter than the males of equal age. The female gorilla looks in its wild state more podgy, or squatter, than the male.

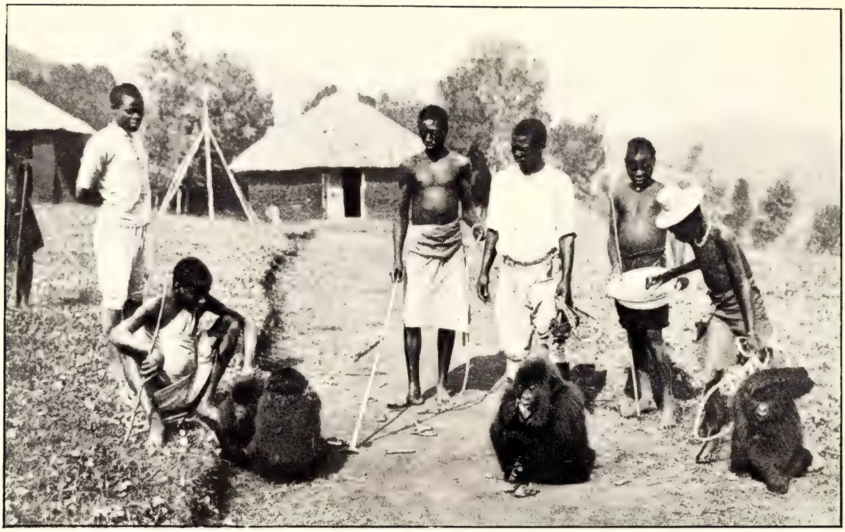
The photograph of the dead male gorilla, as well as those that follow of the captured young ones, were very kindly given to me by Pére G. Provoost of the White Friars Mission at Lulenga, in the Kivu District. The official seated beside the animal's body is the late Commandant Elias Arrhenius, a well-known Swedish gentleman who was in the service of the Belgian Congo Government. Arrhenius, who it will be remembered, accompanied Prince William of Sweden to these parts, was among the first to send specimens to Europe. This particular one, together with the pair of female gorillas also shot by Arrhenius, appears to have reached the Swedish Museum of Natural Science in the year 1916, although they were secured before that date.



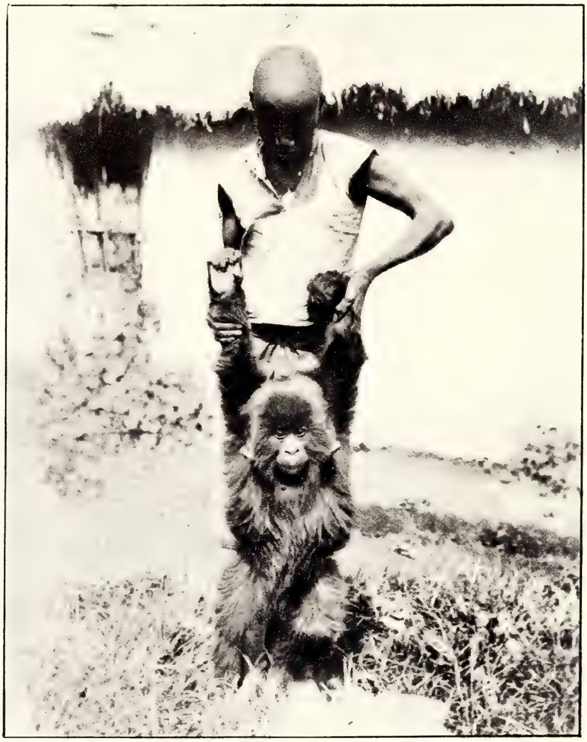
No. 11. An adult male Gorilla.
(*See Explanation of Plates.*)



No. 12 A pair of female Gorillas secured on Mt. Mikeno.
(*See Explanation of Plates.*)



No. 13. Four captured young Gorillas.
(*See Explanation of Plates.*)



No. 14. One of the four young Gorillas
with its guardian.

It will be seen from the photographs of the young gorillas, captured in the same region (Mount Mikeno), that they differ materially from the adults. The very young ones have their whole body covered with the coarse hair except the face and parts of the hands and feet. The glabrous skin of the face is black and shiny. The nostrils are large and prominent, and the deeply set eyes almost hidden by the overhanging brows. The hair is jet-black and coarse and resembles that of the common Himalayan Black Bear. In fact, the first glimpse of a young female gorilla moving on all fours through the undergrowth reminds one much of the black bear in India. One of the four young gorillas, a female, figuring in the adjoining illustration, reached the Antwerp Zoological Gardens but died unfortunately some time towards the end of 1924. One of the warders of this Zoo, in charge of the Monkey House, informed me that it had succumbed to an abscess of some kind in the throat, after an unsuccessful operation. Its food in captivity consisted of bananas, apples and vegetables. Celery, I should imagine, would be the nearest approach to the gorillas' natural food in its mountain home, which as already stated, is a kind of wild chervil with long blanched and succulent stalks.

Another of the four specimens, if I am rightly informed, died during the sea voyage, and the remaining two perished locally in the Congo.

The capture of such young gorillas can easily be effected, in suitable localities, by creating a sudden commotion among a troop by concerted shouting and the firing of a rifle. Thus embarrassed, in the confusion the young ones are separated from the others and give an opportunity to the pursuers to close in and throw a sack, or blanket over the terror-stricken creatures. Unfortunately such a procedure is apt to involve the killing of one or two of the adults among the party.

With adult individuals, especially the males of more advanced age, the chest is bare to a well defined line about the waist, with the skin wrinkled on the breast, forming in the old males distinct creases. The back of the adult male exhibits a patch of grizzled hair, which develops with advancing age into a broad and conspicuous silver-grey band across the loins. The crest of hair growing on a fleshy swelling along the line of the sagittal suture, is very prominent in the male, much, more so than in the female. This sagittal crest is only erected to its full extent when the beast has been molested and is thoroughly roused, either enraged or terrified. The same habit is, of course, frequently exhibited by many other mammals.

It will, however, be noticed that the gorilla does not, as monkeys usually do, display their endeavour to terrify their antagonist by approaching in abrupt starts. The adult male gorilla carries his bluff further by a continuous advance in the upright attitude to within very close proximity of the intruder. By such means he is confident and no doubt accustomed to succeed in scaring the occasional Batwa hunters that venture to seek their honey and other edible forest resources in these regions. At a distance he will not embark upon this advance, but will usually content himself with breast-beating and other signs of defiance and displeasure. In their normal mood these great apes look phlegmatic and good-natured. There is a varied individuality in their appearance and features. Chest measurements of dead specimens at sixty inches in fully-grown males have been recorded, and even a couple of inches more. These measurements would naturally be proportionately more for the expanded chest of the live animal. Although their maximum height is known to be in the neighbourhood of only six feet from the crown to the heel, the weight of an adult male exceeds that of two men of average weight. Some old males have been secured in these regions which are stated to have weighed between four and five hundred pounds. The short, bowed legs of the gorilla, supporting the heavy, pot-bellied body, the excessively broad and square shoulders and the long and powerful arms, reaching to the knees when the creature is erect, give the Kivu Gorilla its singularly stocky and massive appearance.

Arboreal Habits

Although on the whole the Kivu Gorilla is not arboreal in its habits, as can be seen at once from an examination of its hands and feet,[1] it should not be presumed that it is always a clumsy climber. In the lower forest regions of Mount Mikeno, at an elevation of approximately 8,000 feet, it is not unusual to see a young or a sub-adult gorilla climbing a tree some forty to fifty feet in height. In such a case, the favoured observer will be astonished to perceive the deliberate and, as it struck me at the time, methodical manner in which these apes are able to ascend the tall trees, in much the same way as a man climbing up a pole, fitted with cross-spokes, i. e. in an upright posture and using the human overhand movements. They can remain comfortably perched among the top branches, every now and then phlegmatically reaching out their long hairy arms and plucking at some favourite morsel in the way of a fruit or some young shoots. It is surprising to see how well they blend with the foliage and how little of their body is exposed to the observer, giving no chance of a successful snapshot. In the cases witnessed, I have invariably seen them descend by the stem by which they ascended, and in the same way. They seem to be far from at ease when they are surprised in a tree. In such a case they will, after a moment devoted to satisfying their curiosity climb down promptly and move off through the undergrowth.

They may at times remain hidden among the thick vegetation at the base of some tree and utter their spasmodic bark of defiance with the object of deterring the intruder from further interference.

On one occasion I spent the greater part of an afternoon in the

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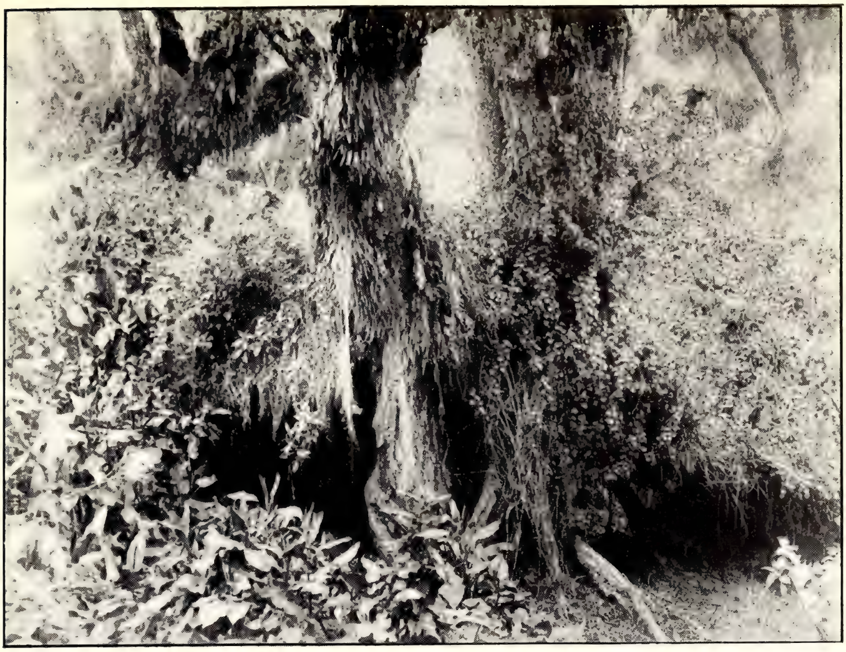
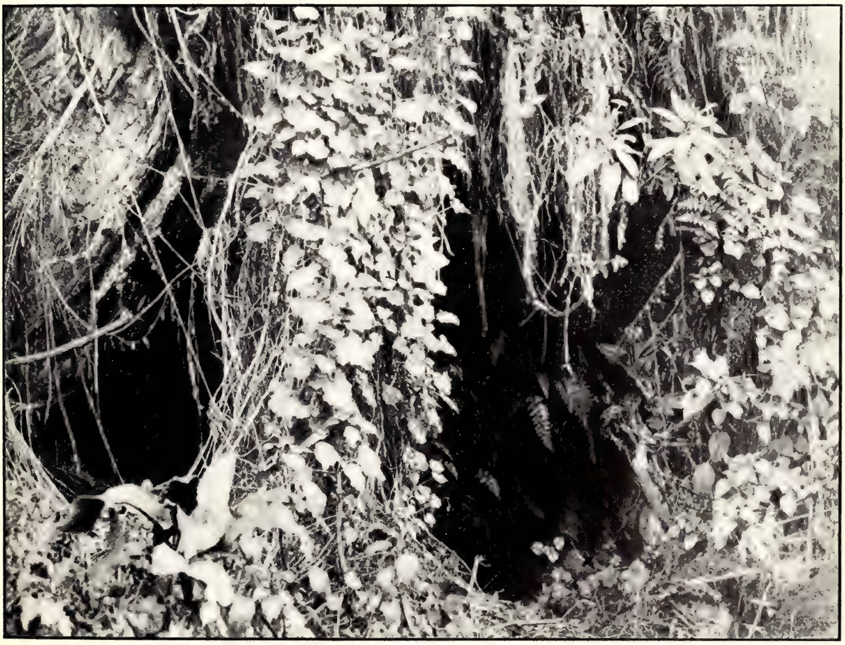
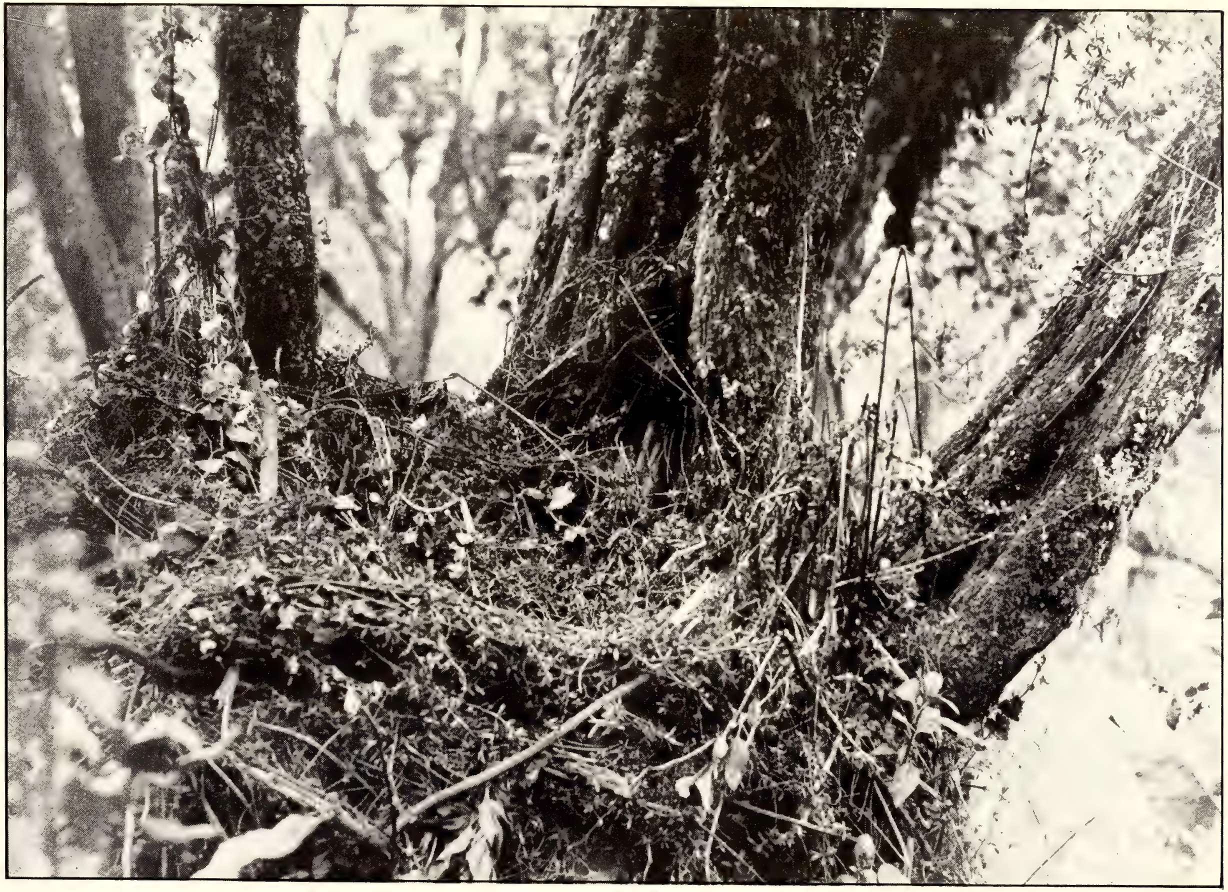
[1] It is known that the hand of the gorilla is relatively shorter and broader than in any of the other apes, the Orang-utan, or the Chimpanzee. It is the same also with regard to the feet, which are almost flat and not arched as in man, with the big toe widely separated from the other digits as in the other apes. The photograph of the dead male shows that the fingers are short, tapered, and thick at the base. In the foot, as the tracks of the gorilla on soft ground will show, the heel is distinctly in evidence. The digits of the animal's foot are somewhat webbed at the base, making the small toes appear short and stumpy.



No. 15. A Gorilla Shelter in the hollow base of a large tree.
(*See Explanation of Plates.*)



No. 16. A recently vacated Night Shelter of a family of Gorillas showing the excrements of the Apes (x) in the right foreground.
(*See Explanation of Plates.*)



No. 17. A Gorilla "Bed" or "Nest" formed in the crotch of a bifurcated tree on the western slopes of Mt. Karisimbi at an altitude of some 11,000 ft.

(*See* ***Explanation*** *of Plates.*)

close vicinity of a troop of feeding gorillas, in the hope of being able to secure a snapshot. The troop, which may have consisted of a couple of dozen or more members, were busy feeding within the confines of a very dense bamboo clump. Beyond hearing the loud snapping or the splitting of stems at intervals, occasional grunts, or a bark, we saw nothing but a stray glimpse of a peeping head or a passing body. The flock, which we had disturbed earlier in the day, was well aware of our presence but appeared now to pay not the slightest heed to us. They pretended to be unaware of any scrutiny and went on with their feeding, freely and without a care.

It appears quite evident that they are incapable of swinging themselves from tree to tree as do the Orang-utans, for instance. This is not difficult to understand, if we consider their external anatomy. It is worth noting, however, that the younger gorillas are capable of moving over the tops of dense bamboo thickets, causing comparatively little damage to the trees, considering their weight and bulk. In such case, they can spread themselves out sometimes with their arms apart, and crawl, so to speak, over the bending clusters of bamboo tops, snapping an occasional weak stem by their weight. The heavier males content themselves with seeking their food at the base of the trees, causing at times a regular din by the intermittent snapping of bamboo stems. The noise created in a bamboo patch by a troop of a couple of dozen feeding gorillas is not unlike that caused by a few elephants feeding in similar forests. On the other hand, among open forest in the higher altitudes, I found the gorillas singularly quiet and almost silent, unless they happened to be suddenly startled at close range. They remain quite silent throughout the night. A bamboo patch evacuated by a large flock of about a couple of dozen individuals bears ample testimony to the strength of which these animals are possessed, especially the old males, not only in the shape of broken bamboos some two and a half to three inches thick, but also of split bamboo stems deliberately twisted.

Among the forests of the higher regions, the gorilla may show a certain slowness, amounting almost to clumsiness, when they proceed on all fours along the overhanging or slanting branches of the Hagenia trees. This is readily understood if we consider the animal's configuration, and bear in mind the fact that the abdomen, especially in large individuals of advanced age, protrudes considerably, and gives a markedly pot-bellied appearance. The great weight of these heavy apes must also be taken into account.

Sleeping-places, Food and Enemies

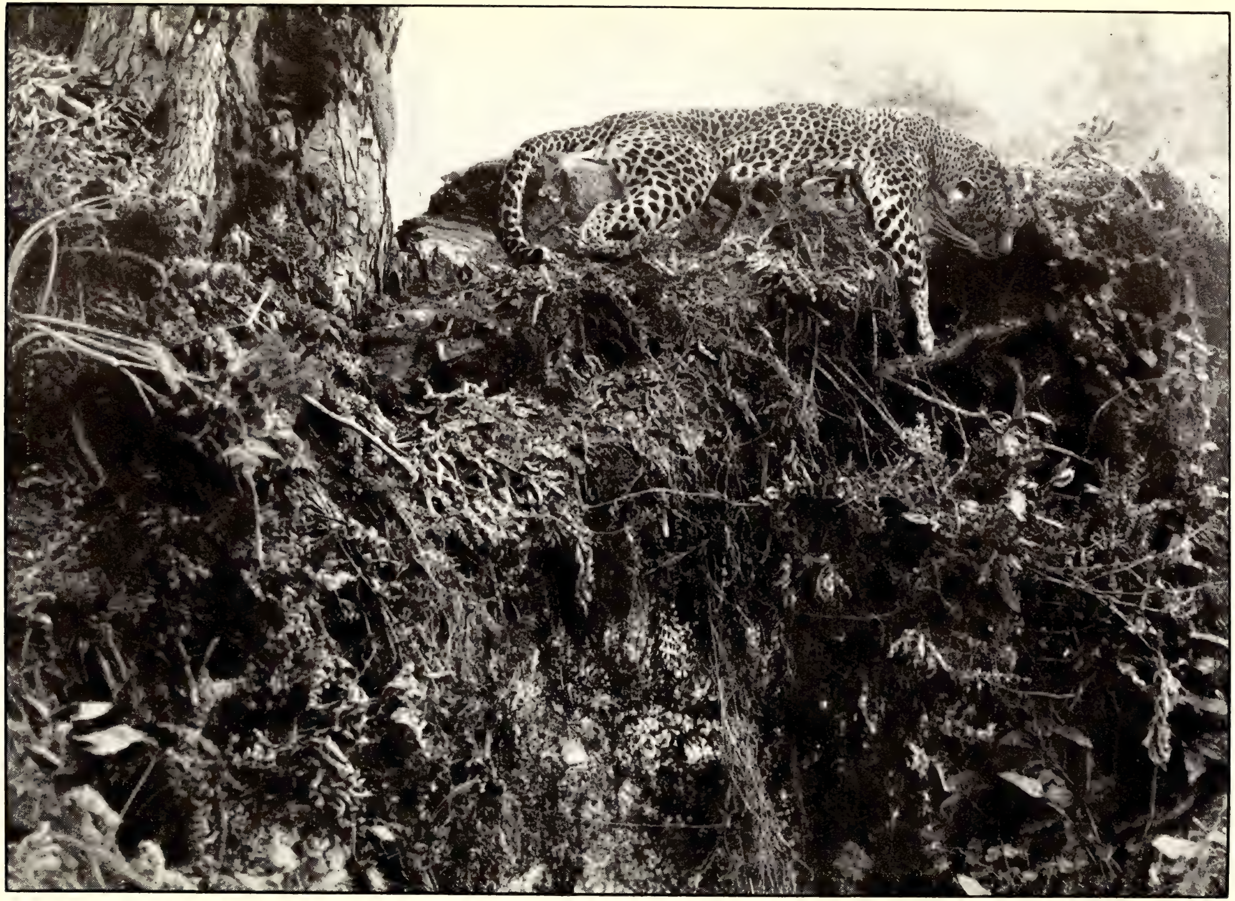
Sleeping-places are commonly met with, and gorilla tracks are plentiful in certain localities. These apes move about a good deal and are constantly changing their feeding grounds. Their unsheltered resting-places are made of twigs and leaves heaped up a few inches from the ground, and generally bear the deep impression of their posteriors, as they squat on these 'ground-nests'. The young ones, as the traces show, huddle at night round their parents. It is not infrequent to see these nests fouled, and their vacated sleeping-places are often littered with dung. Their proper night-quarters are mostly sheltered, and the following photographs will give an excellent idea of these retreats. The shelters are also sometimes occupied in the day time at intervals during heavy thunderstorms. The sleeping-places are, as a rule, not used on two nights in succession. The gorillas of these regions appear to be continually on the move from day to day, and seem to favour certain surroundings. This is a curious fact as there cannot be any question of scarcity, nor any marked difference in the food on the slopes, or ridges, in whichever direction they happen to turn. The shelters have often the appearance of a natural wigwam formed at the bifurcated or hollow base of some old Hagenia tree, with low and massive overhanging branch; they are curtained with a profusion of luxuriant vines and climbers. One of the photographs shows the nature of this creeper-vegetation round a newly-vacated gorilla night-shelter. In one corner may be noticed the excrement (marked with a cross) of the departed occupants, reminiscent of the dung of a horse. This was a snug and spacious retreat, which could have offered a comfortable rain-shelter for some half-a-dozen men. In some cases, the space is just enough to accommodate one large male: here the old man gorilla squats on his 'throne' apart from his family, surrounded by a drapery of creepers, which offers effective protection against wind and rain. The old animal is, moreover, enabled to peer from his eminence over the immediately surrounding undergrowth, as the shelters are often situated on the ridges or slopes.

Whereas the adult male gorilla seems to prefer the ground seats, it not infrequently happens that the younger members of a flock occupy small platforms, from four to six feet above ground level: such little platforms, which resemble nests after they have been occupied, are usually roughly built in the crotch of some large Hagenia tree.

The food of these animals consists mainly of tender bamboo shoots, sorrels, hemlocks, etc., and especially the pith of the parsley-like plants already referred to as the wild chervil. Berries are also eaten, and one finds, in addition, the remains of stalks of the taller plants from which the bark has been neatly peeled off and chewed.

As regards enemies of the gorilla, it may safely be accepted that no herbivorous forest animal would feel inclined deliberately to disturb a troop of gorillas, or even to remain for any length of time in their immediate vicinity. On the other hand, I have reason to believe, from the presence of leopards prowling on the skirts of a party of gorillas that, as has been already mentioned, these wily animals, with the patience and cunning characteristic of such prowlers, prey upon an occasional young gorilla. The gorillas of these forests cannot be regarded as particularly wary. The adult male gorillas are doubtless free from any kind of persecution by beasts of prey, and therefore more unwary. The young gorillas appear ignorant of their enemies; nevertheless they do not stray far from their parents.

Apart from the strenuous exercise with which the stalking of these great apes is invariably associated in a mountainous country



No. 18. Dead Leopard on the branch of a large *Hagenia* tree, showing a vacated Gorilla Shelter below.

covered with luxuriant vegetation, where, moreover, the atmosphere is mist-laden and rarified, the shooting of these animals can present no difficulty to the determined hunter. Few Europeans, however, would feel inclined to take the life from these normally harmless creatures, unless they were wanted for a definite purpose. The gorilla is, in these regions, by no means as rare as he has been supposed to be. The difficulty of obtaining photographs does not lie so much in actually surprising the animal in his mountain home as in finding circumstances which will allow a snapshot to be taken with a reasonable hope of success. The securing of a really effective picture remains at all times largely a matter of luck, although, of course, the greater the patience and determination exercised the greater the chance of success.

NOTE ON THE GAIT OF THE GORILLA

As to the gait of the gorilla it is clear that in the wild state but few opportunities are obtainable for observation, owing to the difficult nature of the forest undergrowth.

Although rarely, they may yet at times expose themselves almost completely when they happen to move across the trampled vegetation of their feeding tracks. Much can be learned from the animals' spoor on the damp and soft humus soil.

In captivity the animal shows quite clearly the nature of its gait, as may be seen by watching the young West African specimen which was for a time at Regent's Park. It was found to exhibit three distinct gaits, namely: The walk on all fours, the upright walk, and the run.

In the first instance there is nothing unusual about the motions of their limbs as they are identical with those of a baboon moving on all fours. The application of the extremities of its limbs to the ground is, however, entirely different, since the gorilla, like the Orang-utan and Chimpanzee, does not place the palms, but the knuckles of the flexed hand on the ground. In the case of the feet, it walks on the outer margin of the sole and heel with the toes somewhat bent downwards.

Their walk in the upright attitude, in contradistinction to that on all fours, is in appearance not unlike the toddling gait of a pronouncedly bandy-legged child.

Their accelerated mode of progression, or run on all fours resolves itself into the following impacts, namely: right knuckles—left knuckles—margin of right foot pad—margin of left food pad. In fact, the impacts themselves succeed one another in much the same way as in the canter of a four-footed animal, i.e., a transverse motion. The arms of the gorilla being very long in proportion to its bowed legs, the body naturally slopes at an angle towards its posteriors, and consequently causes the head to remain more elevated than in the baboon, for instance. The forward progression of the body, in the run, is accompanied by a slight side swing, an almost imperceptible side twist, of the animal's hind quarters.

Although the great toe of the gorilla is widely separated from the smaller digits, and forms with the latter a prehensile foot, it will be noticed in the young specimen at the Zoo that in its erect, as well as in its stooping gait the great toe is usually held in close to the other digits. The large toe is held somewhat flexed, with the ball turned inwards and slightly downward. The creature walks normally on the outside margin of its heel and foot pad and holds the sole slightly at a slant. Its tracks on the soft mud usually show a deep impression of the outer edge of the foot and heel, and a faint impression of the small toes.

FULLER EXPLANATION OF PLATES

No. 1

Mount Mgahinga (11,400 ft.) with Mount Muhavura (13,547 ft.) in background. Taken in the evening from the slopes of Mount Sabinio.

No. 2

Mr. James Hugh Barnes, Mr. Maxwell's companion, with the porters. The outline of the preciptous peaks of Sabinio, seen in the background, bears resemblance to that of a molar tooth. This photograph was taken from a point on the saddle between Sabinio and Mount Mgahinga, at an altitude of 8,600 feet. It is remarkable with what scanty clothing these natives can face the raw cold on these heights. The steep slopes of Sabinio are covered with bamboo to a height of nearly 9,000 feet from which altitude commences the subalpine vegetation, first the arboreal heaths and finally the alpine groundsels with lobelias among the Alchemilla meadows.

No. 3

Panoramic view of Mount Mikeno (14,385 ft.) and Mount Karisimbi on the left (14,633 ft.), with the summit of the latter hidden in the clouds. This photograph was taken from a spot, to the east of Mikeno, with an altitude of 8,400 feet. On these two mountains the bamboo forests cease at a height of some 9,000 ft. and the vegetation from this height to about 12,000 ft. consists mainly of Hagenia trees with widely spreading branches, amidst a meadow undergrowth of chervil-like plants, nettles and other harbaceous growths, interspersed with tall giant lobelias. Above 12,000 ft., the arboreal heaths, giant groundsels and lobelias, among other alpine plants, make their appearance more common, and take the place of the Hagenias; a soft carpet of Alchemillas and different kinds of drab moss constitutes the ground vegetation. The three zones of flora can roughly be distinguished on the photograph. Traces of gorillas are met with from an altitude of 7,000 ft. and are fairly common in places up to 12,000 feet. They become scarce above this height.

No. 4

Panoramic view of Mount Sabinio, taken from an altitude of some 8,000 ft. above sea level, looking up into the north eastern gorge. Apart from numerous glens and corries, the slopes of Sabinio are intersected by no less than three immense gorges, one on the north-east, another on the south-east and a third on the north-western slope.

The white patch of smoke, on the right-hand side of the throat of the gorge shown about half-way up the mountain, indicates Mr. Maxwell's night camp, at an altitude over 9,000 ft.

No. 5

Hagenia trees among the carpet of a soft undergrowth consisting of nettles, docks, sorrels, hemlocks and mainly of a plant resembling a wild chervil, which is a favourite food of the gorilla. This scene represents a typical forest of Mikeno at an altitude of 11,000 ft. and thereabouts. The height of the undergrowth is indicated by the native standing on the right-hand side of the foreground.

No. 6

Another forest scene on the same altitude and showing a portion frequented by gorillas.

No. 7

A forest of *Hagenia abyssinica* with a view on the western slope of Mikeno, looking up towards its summit. This view was taken at an altitude of a little over 9,000 feet. The poker-like tops of a few giant lobelias are visible in the foreground.

No. 8

Arboreal Heath (*Erica arborea*) and Senecio, or giant groundsels (*Senecio johnstoni*). Note their respective heights by comparison with the figure below the trees.

No. 9.

The summit of Mt. Mikeno, height 14,385 ft. Taken from a point over 12,000 ft. in altitude to the south-east of this peak. The peak is occasionally covered with snow at the summit and frequently enveloped in clouds. In the foreground can be seen the crowns of the last Hagenia trees. Note the alpine vegetation on the slopes of the peak.

No. 10.

A startled female gorilla making off with her young on her back. Indistinctly, on the right, about halfway up the slope may be seen a sub-adult Gorilla showing the upper part of its body above the undergrowth. This photograph was taken on the Western slope of Mt. Karisimbi, at an altitude of some 11,000 ft.

No. 11.

An adult male gorilla, shot by the late Commandant Elias Arrhenius for the Swedish Museum of Natural Science.

No. 12.

A pair of female gorillas, secured by the late Commandant Arrhenius and destined for the Swedish Museum of Natural Science. The specimens were secured on Mount Mikeno.

No. 13.

Four captured young gorillas, of which two were destined for the Antwerp Zoological Gardens but only one of the two reached Antwerp. The remaining two appear, from accounts given to me, to have died locally.

No. 14.

One of the four young gorillas with its guardian.

No. 15.

A gorilla shelter in the hollow base, and among the bifurcated roots of a large tree. It forms a snug and spacious shelter for several people. Note the vegetation round the roots and the luxuriant growth of the mosses.

No. 16.

A recently vacated night shelter of a family of gorillas, at the base of an old Hagenia tree. Note the nature of the vegetation at this altitude (approximately 11,000 ft.) and the excrements of these apes on the foreground, to the right of the trellis of climbers in the centre.

No. 17.

A gorilla 'Bed' or 'Nest' on the western slopes of Karisimbi, formed in the crotch of a bifurcated tree. The 'Nest' is about four feet from the ground. As their traces point out the adults prefer their resting places on the ground. The young ones occasionally occupy such elevated little platforms, a few feet from the ground. This photograph was taken at an altitude of some 11,000 feet.

No. 18.

Dead leopard on the branch of a large Hagenia tree. Below the branch is a vacated gorilla shelter.

INDIAN DRAGONFLIES

BY

F.C. FRASER, LT.-COL., I.M.S., F.E.S.

Part XXIX

(*With three plates.*)

(*Continued from page 319 of this Volume*)

Genus—RHINOCYPHA Ramb. (*cont.*)

Group—*perforata*.

Rhinocypha whiteheadi, Kirby, Ann. Mag. Nat. Hist, (7), vol. v, p. 536, pl. xii, fig. 4 (1894) ; Martin, Mission Pavie, Nevrop. (sep.) p. 17 ; Laid. Rec. Ind. Mus., vol. xiii, pp. 38 and 39, (1917) ; Fras. Mem-Pusa. (Ent. Ser.), vol. vii. No. 7, pl. viii, fig. 4 (1922)

Male. Abdomen 17 mm. Hindwing 21 mm.

Head : labium and labrum and rest of head velvety black marked with blue as follows :—a reniform or oval spot on the outer side of each hinder ocellus, a smaller postocular spot behind it and a medial linear occipital spot behind them.

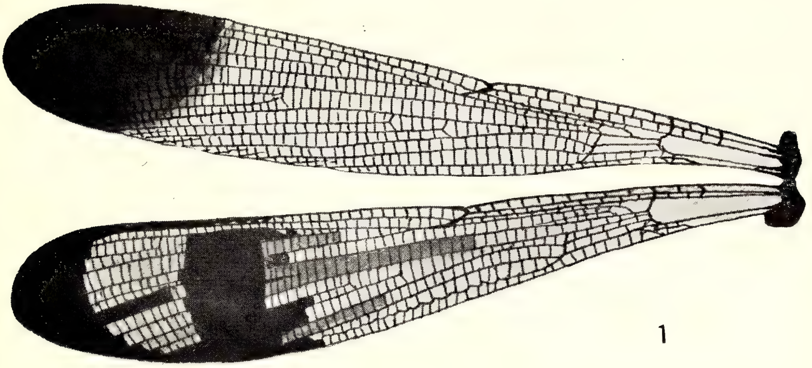
Prothorax black marked on each side with a rounded pale blue spot, and a large blue spot on the dorsum of posterior lobe and hinder portion of middle lobe, shaped like an arrow-head.

Thorax velvety black with a dark violet lustre, marked with azure blue and chrome-yellow as follows :—the mesothoracic triangle pale blue, extending considerably less than half-way up the dorsum of thorax, and very broad at base, far more so than in others of the genus ; an antehumeral stripe consisting of a small isolated spot above and a narrow curved stripe on the lower half of dorsum ; a fine posthumeral stripe closely apposed to the humeral suture, broken above to leave a small isolated spot, behind which is another elongate larger spot, all blue A broad interrupted stripe on lower part of sides, yellow, but the portion on the metepimeron, blue anteriorly. Pruinosed white beneath.

Legs black, the two hinder pairs of tibiæ, and the femora pruinosed white.

Wings hyaline palely tinted with yellow at the bases, opaque blackish brown apically, the hindwing marked on this part with three rows of vitreous spots. Forewings with the apical portion opaque blackish brown as far inwards as, rather more than half-way from apex to node, extending nearer the node along costal border of wing, the inner border of the area serrate and running obliquely backward and outwards ; pterostigma black, the cells immediately beneath it hyaline. Hindwing with opaque area darker and extending inwards for about three-fourths the distance between apex and node, its inner border very irregular, indented and serrate. The vitreous spots a beautiful violet from whatever angle viewed. The apical spot single, 4 cell-rows deep by 6 cells wide, irregularly shaped, situated 3 cell-rows behind pterostigma, which is black; the middle row of spots 3 in number, all in alignment and of about equal length, about 10 cells wide, the costal spot lying between *IRii* and *Riii*, the mid spot between *IRiii* and *Riv + v*, the hinder spot between *Cuii* and *IA* ; the proximal spot single, short, only 5 cells long, lying between *IRii* and *Riv + v*, projecting slightly into the opaque area. All wings with 14 to 15 antenodal nervures ; discoidal cell traversed 3 times in the forewing, 4 times in the hind ; wings petiolated to level of 2nd *an* ; 21 to 26 postnodals. Wings of approximately the same shape and length, long and narrow, the hind slightly broader than the fore.

Abdomen black marked with azure blue as follows :—segments 1 to 4 with lateral rounded spot at apical end of segments, growing successively smaller



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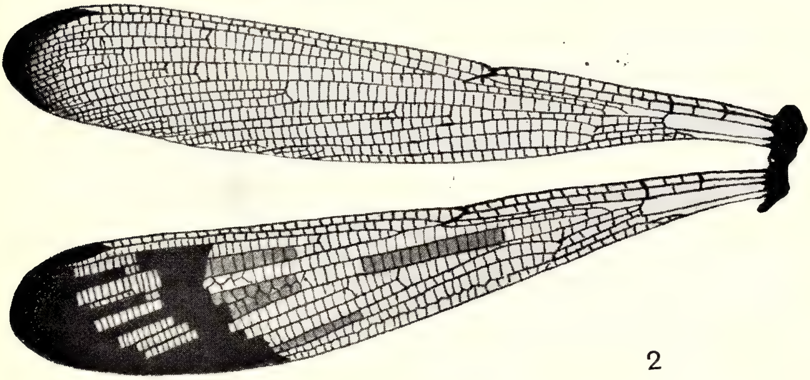

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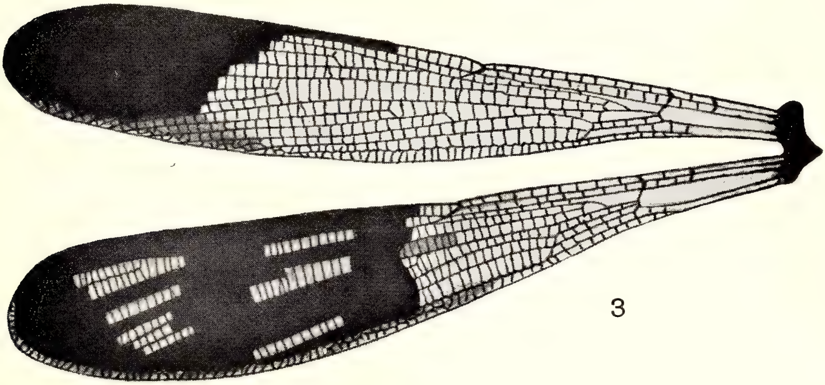

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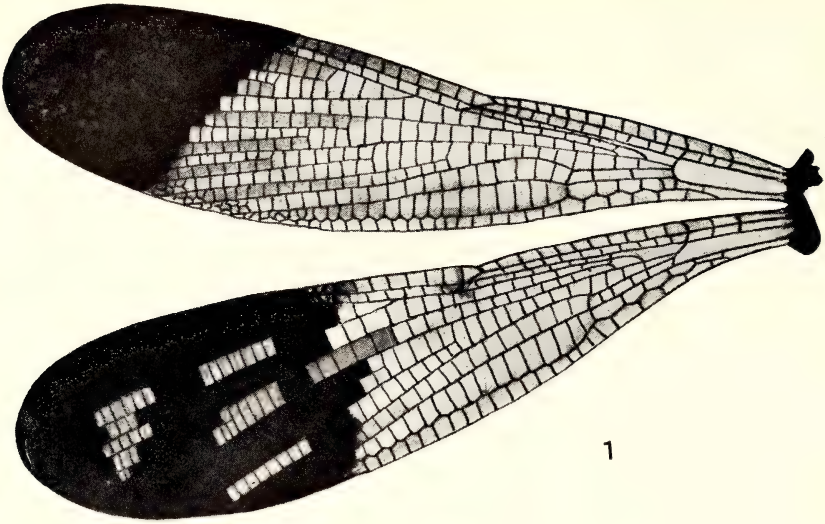
1. WINGS OF *Rhinocypha bisignata*, Selys, male.
2. WINGS OF *Rhinocypha biforata delimbata*, Selys, male.
3. WINGS OF *Rhinocypha perforata perforata*, Perch, male.



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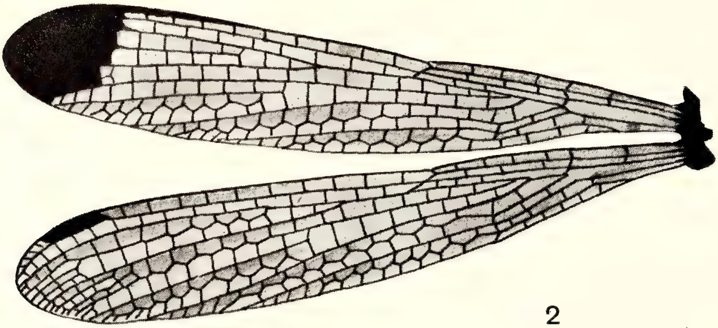

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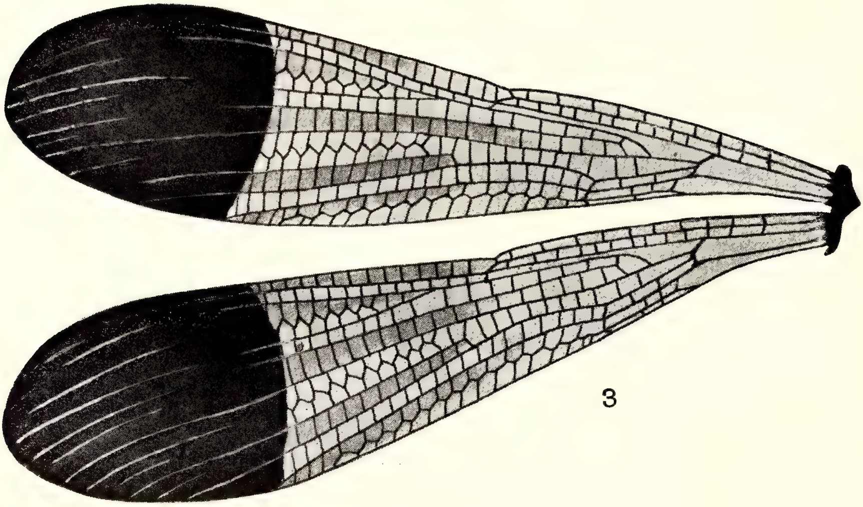

3

1. WINGS OF *Rhinocypha whiteheadi*, Kirby, male.
2. WINGS OF *Micromerus lineatus*. Burn., male.
3. WINGS OF *Calocypha laidlawi* (Fras), male.

from 1 to 4, segment 1 has also the apical border narrowly lined with blue, and there is a short ventro-lateral stripe on segments 2 and 3. Anal appendages shaped as for genus ; inferior appendages with a series of small robust spines on upper surface.

Female. Unknown.

Distribution. Cachar, Assam. Very local but apparently not uncommon where found, to judge by the numbers taken by Mr. Antrim. Martin reports it from Tonkin, but I was unable to find any specimens in his collection in the Paris Museum, and infer that he has mistaken a race of *perforata* for this insect. There is a single male from Sibsagar, Assam, in the Indian Museum collection. Although belonging to group *perforata*, it is not very closely related to *perforata* itself, and cannot even be considered as a subspecies of that insect as has been suggested. Its wings are not only broader than *perforata* but are distinctly rounded at the apices. It ought not to be difficult to discover the female of this beautiful insect.

Rhinocypha perforata perforata Percheron. (*Agrion perforatus*), Gen. Ins. Neur. t, 2 (1835) ; Ramb. Ins. Nevrop., p. 235 (1842) ; Selys, Syn. Cal., p. 63 (1853) ; Id. Mon. Cal., p. 219 (1854) ; Id. Bull. Acad. Belg. (2), vol. xxxv, p. 487 (1873) ; Walk. (*Libellago perforata*), List. Neur. Ins. B.M., vol. iv, p. 647, No. 7 (1853) ; Kirby, Cat. Odon., p. 114 (1890) ; Mart. Mission Pavie, Nevrop. (sep.) p. 17 (1912) ; Will. Proc. U.S. Nat. Mus., vol. xxvii, p. 174 (1904) ; Krug. (*R. apicalis*) Stett. Ent. Zeit. p. 79 (1898) ; Laid. (*R. inas*) Proc. Zool. Soc., Lond., pp. 88–90, pl. vi, fig. 6 (1902) ; Id. (*R. apicalis*) Fascic. Malayensis (Zool), part 1, p. 196 ; Id. Rec. Ind. Mus., vol. xiii, pp. 38, 39, (1917) ; Fras. Mem. Pusa (Ent. series), vol. vii, pl. viii, fig. 3 (1922).

Rhinocypha perforata perforata is not found within Indian limits, but is represented by its subspecies or races *limbata* and *beatifica* described below. The type comes from Cochin China, and cotypes exist in the Maclachlan collection from the Isle of Hainan, China, collected by Swinhœ. It differs from *limbata* by not having the border of the apex of hindwing vitrefied hyaline and by the reduced opaque area in both fore and hindwings. In the forewing this area occupies a little more than the apical fourth, but in the hindwing extends to within four cells of the node. In *limbata* this area extends nearly up to the node in the forewings, but is variable in the hind, usually to about the same distance from the node, whereas in *beatifica* it extends right up to the node. Type in Paris Museum.

(In referring to my paper in the Memoirs of Pusa cited above, I note that the figures have been wrongly numbered in the plate. Figure 4 is really *R. whiteheadi*, and figure 3 should be *R. perforata limbata*.)

Rhinocypha perforata limbata, Selys, Bull. Acad. Belg. (2), vol. xlvii. p. 392, (1879) ; Kirby, Cat. Odon. p. 114 (1890) ; Laid. Rec. Ind. Mus., vol. xiii, p. 38 (1917).

Male. Abdomen 16–18 mm. Hindwing 25 mm.

Head : labium dirty white, the apices of lobes black ; labrum and rest of head velvety black with a small rounded spot on the outer side of each posterior ocellus, a larger rounded postocular spot and a linear medial spot on the occiput, all bluish.

Prothorax black with the greater part of the posterior lobe rose pink or lilaceous, and a large blue spot on either side of the middle lobe.

Thorax velvety black, the mesothoracic triangle extending rather more than one-third up the dorsum, lilaceous in colour. On the outer side of this triangle, and slightly longer than it, a large subtriangular azure blue spot with its hinder border meeting the anterior part of the humeral suture. Above this spot a small triangular upper humeral spot also blue, whilst laterally the greater part of the sides are of the same colour, viz., nearly the whole of the mesopimeron, the upper two-thirds of the metepimeron and a narrow prolongation along the hinder border of the humeral suture going as far as the root of forewings. Beneath thorax 2–4 yellow spots which may be somewhat obscured by pruinescence. In the Siamese and Annamese forms, there are only two small rounded spots at the hinder part of thorax, whereas in specimens from Assam, there are two additional larger oval spots in line with and in front of these.

Legs black, the flexor surfaces of the two hind pair of femora and tibiæ pruinosed white or creamy white.

Wings very long and very narrow, of equal breadth, hyaline in the basal portions where they are palely tinted with yellow; opaque blackish brown in the apical portions, marked with two series of vitreous spots in the hindwings. Forewings with the outer third only opaque, this area stopping short of the hinder border of wing, with a serrate border proximad and prolonged inwards along the costal border between the costa and *Ri*, to within 2–4 cells of the node; the hyaline border of wing posterior to the opaque area vitreous with bluish, violaceous or green reflex which may extend as far as the extreme apex of wing. Pterostigma black; 15 antenodal nervures, 24 postnodals; discoidal cell traversed twice only; petiolation ends at level of 2nd antenodal nervure. Hindwing with opaque area extending inwards to within 1 to 4 cells of node, the proximal border of this area ragged and indented deeply by a vitreous spot 8 or 9 cells long, between *IRiii* and *Riv + v*. The hinder border of wing narrowly hyaline and vitreous, finely reticulated and extending round apices of wing as far as pterostigma. The apical series of vitreous spots very variable, usually composed of 3 linear spots which decrease in length from costa to hinder border of wing and which slightly overlap the level of inner end of pterostigma. The costal spot 11 to 16 cells long, lying, between *IRii* and *Riii*; the hinder spot 3 cell-rows deep by 4 to 8 cells long, lying between *IRiii* and *Riv + v*, whilst the middle spot, which is 2 to 3 cell-rows deep by 9 to 10 cells long, lies midway between the two others banded by short intercalated sectors; the inner series lying rather nearer the node than pterostigma, composed of 3 spots, a costal spot 1 cell-row wide by 10 cells long, lying between *IRii* and *Riii*, a medial spot 2 cell-rows wide by 10 to 15 cells long between *IRiii* and *Riv + v*, and a hinder spot 1 cell row wide by 9 to 12 cells long between *MA* and *Cuii*. All these vitreous spots and areas glowing emerald green or opalescent according to the angle from which viewed; 28 postnodal nervures, 14 to 15 antenodals; discoidal cell traversed 3 to 4 times; petiolation the same as for forewing; pterostigma black.

Abdomen black marked laterally with azure blue as follows:—segment 1 with a large cuneiform spot on each side, 2 with a bilobed, longitudinal spot extending from near the base to apical border, 3 to 4 with long wedge-shaped spots with base of wedge at apical border of segments, segments 5 to 9 with short triangular apical spots, that on 9 being very reduced.

Anal appendages black, superiors slender, cylindrical, semi-circular, a little broadened at apex which is curved strongly in. Inferiors half the length of superiors, moderately separated, bluntly pointed, a little denticulated at apex. The superiors minutely spined on the outer sides near apex.

Female. Abdomen 18 mm. Hindwing 26 mm.

Differs from male by having the wings entirely hyaline, tinted palely with greenish yellow; pterostigma blackish brown, its outer half yellow at the centre, especially in the hindwings; 13 to 15 antenodal nervures in forewings, 26 to 30 postnodals.

Head similar to that of male with the addition of a large spot of yellow on upper surface of epistome and two smaller ones behind it. The spots on vertex and occiput also yellow, body-markings same as for male but yellow instead of blue, the mesothoracic triangle finely outlined in yellow, its centre black.

Legs black, tibiæ and femora not pruinosed. Abdomen black with yellow markings as for male, but with additional ventro-lateral stripes on segments 2 to 5. Vulvar scale as for genus.

Distribution. *Limbata* extends from Annam, through Siam to Burma and Assam. The type in the Selysian collection, is from East Burma. The type of *perforata perforata* is from Cochin China and is distinguished from *limbata* by the total absence of the hyaline and vitreous border of the hindwing, the opaque area here coming right down to the border of wing, at least along the extreme apex. The abdominal markings, said by Selys to be more restricted in *limbata*, are not found to be so when a series of specimens are examined. In the forewing at least, the opaque area is greatly reduced as compared to *limbata* or *beatifica*.

Rhinocypha perforata beatifica, Fras. Rec. Ind. Mus., vol. xxix, pp. 86–87 (1927).

Similar in size and markings to *limbata*, from which it differs by the greater extent of the opaque area in all wings, extending in the fore and hind right up to the level of node. This is especially noticed in the forewings, where not only does the costal streak extend to node, but also the body of the area, the serrated border running from the node and extending as far as the apex of wing, leaving a rather broader area of hyaline border than is found in *limbata*. In the hindwing, the hyaline border broadens out at apex of wing, extending right up to, or even overlapping, the outer end of pterostigma. This latter has a narrow bluish centre in the hindwing along its outer half, and that of forewing is pale for the same extent. In the outer series of vitreous spots, the middle spot is 2 cell-rows deep and is fused completely with the costal spot, so that in reality there are only two spots in this series.

Distribution. Naga Hills, Assam, from April to June. Type in the Fraser collection. *Beatifica* differs from *limbata* to about the same extent as does the latter from true *perforata*, so that it is quite possible, that given sufficient material, it might be possible to construct a series showing a gradual merging of one into the others. For the present I consider it better to consider the *perforata* series as one species with two subspecies.

Rhinocypha biforata biforata, Selys, Bull. Acad. Belg. (2) vol. vii, p. 446 (1859) ; Id. ibid. (2), xlvii, p. 392 (1879) (*R. biforata*, race *delimbata*) ; Kirby, Cat. Odon. p. 113, (1890) ; Laid. Proc. Zool. Soc. Lond. (1), p. 88. (1902) ; Will. Proc. U. S. Nat. Mus., vol. xxviii, pp. 173 and 179, fig. 12, (1904) ; Laid. Rec. Ind. Mus., vol. xiii, pp. 37 and 38, (1917) ; Fras. (*R. beesoni*) Mem. of Pusa (Ent. Ser.), vol. vii, No. 7, pp. 61 to 63, (1922).

Male. Abdomen 26 mm. Hindwing 23 mm.

The species is not found within Indian limits but is represented by its subspecies—*biforata delimbata* Selys, *biforata beesoni*, Fras, and *biforata abbreviata* subsp. nov. From all these *biforata* is easily distinguished by the greater extent of the opaque area in the hindwings, where it extends right up to the node or a little beyond it. The vitreous spots tend to be longer in *biforata* and the reticulation somewhat closer. *R. beesoni* falls closer to the parent species but curiously enough, is separated from it geographically by the intervention of the other two subspecies.

Rhinocypha biforata delimbata, Selys, Bull. Acad Belg. (2), vol. xlvii, p. 392 (1879) ; Kirby, Cat. Odon. p. 113 (1890) ; Will. Proc. U. S. Nat. Hist. Mus., vol. xxviii, pp. 173 and 179, fig. 12 (1904) ; Laid. Rec. Ind. Mus., vol. xiii, pp. 37 and 38 (1917).

Male. Abdomen 19–20 mm. Hindwing 23–26 mm.

Head velvety black marked with five bright ochreous spots, one-rounded or oval on the outer side of each posterior ocellus, a round postocular spot on each side and a medial oval occipital spot. Labium white, the lobes tipped with black.

Prothorax black, the posterior lobe finely bordered with yellow and with a large rosepink spot in its middle. A large bluish spot on each side near the trochanters and a similar subdorsal spot on each side of middle lobe.

Thorax velvety black marked as follows :—the mesothoracic triangle rosepink or lilaceous, extending less than half-way up the dorsum of thorax but continued as a fine line of the same colour along the middorsal carina as far as the antealar sinus. On each side of the mesothoracic triangle, a large irregularly oval spot of the same colour, much larger than the triangle itself, a small upper antehumeral spot, a broadish stripe behind the upper two-thirds of the humeral suture, the greater part of the mesopimeron, and metepimeron, azure blue. The hinder lateral suture, the lower part of the metepimeron, and a quadrate area on the upper anterior part of mesopimeron all black, the latter area bearing a small isolated blue spot. Beneath 6 large yellow spots separated by black sutures and framed narrowly in black.

Legs black, the two hinder pairs of tibiæ pulverulent white, the same two pairs of femora pulverulent yellow on the flexor surfaces.

Wings hyaline, the greater part enfumed and tinted with yellow, which is most intense near the bases. Forewings with apices tipped with blackish brown, this marking gradually shading off into the hyaline area at outer end of pterostigma (in *biforata biforata* this area begins well proximal of the pterostigma and covers about the outer fifth of the wing) ; discoidal cell traversed 3 times ; 14–16 antenodal nervures, 27–32 postnodals ; petiolation ends at the level of the

2nd antenodal nervure. Hindwings with about the apical fourth opaque blackish brown (the apical third or more in *biforata biforata*), this area marked with a series of four linear vitreous spots, very irregular, each varying in length, and the costal three often linked up by one or more connecting cells, the inner level of the spots forming a concavity towards apex of wing, as does also the inner border of the opaque area, which extends slightly more basad along hinder border of wing. Just proximal of the opaque area (projecting into it in *biforata biforata*) a second row of vitreous spots.

The costal one of these spots lying slightly nearer the node than pterostigma, composed of one row of cells, about 12 in number, lying between *IRii* and *Riii*, the second spot shorter, lying more distad, 2 cell-rows deep by 8 or 9 cells long, lying between *Riv+v* and *Riii*, the hinder spot at the same level as the costal, 9 cells long by 1 row wide, lying between *MA* and *Cuii*. In the same space as the medial spot of this series, but lying behind level of node, another vitreous spot 1 row wide by 11–18 cells long. Pterostigma black; 15–16 antenodal nervures, 26 postnodals; discoidal cell traversed 3 times.

Abdomen black marked with azure blue as follows:—a large triangular spot on each side of segment 1, a midsubdorsal and an apicolateral spot on each side of segment 2, as well as a ventro-lateral stripe below them; similar spots and stripes, but longer, on segments 3 to 5; segments 6 and 7 with the ventro-lateral stripe only.

Anal appendages black, shaped as for genus.

Female. Abdomen 15–16 mm. Hindwing 23 mm.

Head black with the same markings as for male, but in addition, the bases of mandibles, the basal segments of antennæ, two large spots on frons and two minute linear spots in front and to the outer side of the anterior ocellus all yellow.

Prothorax black with the following yellow markings:—the hinder border of posterior lobe outwardly finely yellow, a narrow longitudinal medial line, often broken into minute points on the dorsum of same lobe, a geminate point at the anterior end of this on the medial lobe, a largish triangular spot on each side of midlobe and a rounded spot on each side of the anterior end.

Thorax black, marked with blue and yellow as follows:—the mesothoracic triangle finely mapped out in yellow, its centre black, a fine antehumeral line incomplete above and strongly hooked outwards and backward in front, a fine incomplete humeral line, all yellow. The sides similar to the male, blue.

Legs black, not pruinosed, the flexor surfaces of the hinder pairs of femora yellow.

Abdomen black marked exactly as for male. Vulvar scale and anal appendages as for genus.

Distribution. Burmah and Assam, common in parts of the former but apparently rare or local in the latter. I have specimens from Mergui, Lower Burma collected in November, and from Maymyo, Upper Burma, collected in July, the latter specimens by Col. F. Wall. It appears to be the commonest *Rhinocypha* in the Maymyo district.

The measurements differ widely from those given by Selys for *biforata*, but it is obvious that these are incorrect, at least those for the abdomen. The Maymyo specimens are very constant in their markings, especially with regard to the extent of the opaque areas of wings, so that I think *delimbata* should at least rank as a subspecies.

Rhinocypha biforata abbreviata subsp. nov.

In a male specimen from Assam, now in my own collection, and which I have named *abbreviata*, I note the following differences:—

The mesothoracic triangle is considerably smaller than in *delimbata* and the carina above it is unmarked; the antehumeral spot is absent; the forewings have only the extreme tips opaque and the nodal index is considerably lower, (12 antenodal nervures and 21 postnodals); the outer series of spots are discrete and all are much shorter than for type (12 to 13 cells for costal spot in *biforata*, only 6 in *abbreviata*, 18 cells in the second spot, only 14 in *abbreviata*, etc.).

The middle series of spots show the same difference, being only 4 to 5 cells in length and falling well short of the opaque area, although in the hindwing, this area is as extensive as in *biforata biforata*. Finally the proximal spot is only 8 cells in length. The nodal index of hindwing lower, 11 antenodals and 23 postnodals.

Abdomen with markings present on the first five segments only :—a large triangular blue spot on the sides of segment 1, an apical rounded spot, a short mid-lateral stripe and a ventro-lateral stripe on segment 2, segments 3 to 5 as for 2 but the medial stripes absent and the other markings much reduced.

The small size of this insect, the abbreviated vitreous markings, and the reduced abdominal markings are, I think, sufficient to form a well-defined subspecies, bearing the same relation to *biforata* as does *trimaculata* to *ignipennis*.

Rhinocypha biforata beesoni, Fras, Mem. Dept. Agricult. Ind. (Ent. ser.) vol. vii, No. 7, pp. 61 and 62 (1922).

Male. Abdomen 18 mm. Hindwing 25 mm.

R. beesoni shares the characters of *biforata* and *delimbata*, in that the apical opaque area of the forewings is as extensive as in *biforata*, and the same area in the hindwings is as reduced as in—*delimbata*. In—the forewing the opaque area extends 2 to 3 cells proximal of inner end of pterostigma, the inner margin somewhat irregular, bevelled outwardly from costa posteriorwards and prolonged slightly along the costa as far as half-way between pterostigma and node between the costal and radial nervures. There is also a slight prolongation along hinder margin of wing. In the hind wing the opaque area covers nearly the outer third of wing and the middle series of spots extends right up to it or even invades it for a short distance. The length of these spots is slightly greater than in *abbreviata*, but decidedly less than in *biforata* or *delimbata*. The vitreous spots in all these subspecies have a metallic green or coppery reflex in the opaque areas, violaceous in the hyaline area.

The discoidal cells are traversed 3 and 4 times respectively, the forewing has 14–15 antenodals, and 22–25 postnodals. The body markings are similar to those of *delimbata*.

Distribution. The type in the Forest Research Institute, Dehra Dun, comes from Lachiwala in that district, and was collected in the month of November. I have also seen two pairs in the Pusa collection which were collected at Mergui, Lower Burma, during June. There are no records of its having been taken in the vast stretch of country separating these two localities and it may be that some error in tabulating has crept in, for Mr. C. F. Beeson collected in Lower Burma as well as around Dehra Dun. It is easily distinguished from *delimbata* and *abbreviata* by the extent of the apical marking of forewing, and from *biforata* by the much reduced opaque area in hindwing.

Rhinocypha bisignata, Selys. Syn. Calop. p. 62, (1853); Id. Mon. Calop. p. 214, (1855) ; Walk. (*Libellago bisignata*) List. Neur. B. M. vol. iv. p. 648. No. 9, (1853) ; Kirby, Cat, Odon. p. 113, (1890); Laid. Rec. Ind. Mus. vol. xiii, p. 38, (1917) ; Fras. Mem. Pusa. Dept. Agric. (Ent. series) vol. vii, No. 8, pp. 80 and 81, pl. x (1922) ; Id. Rec. Ind. Mus. vol. xxvi, p. 483 (1924).

Male. Abdomen 20 mm. Hindwing 24–26 mm.

Head. Eyes brown, rest of head, including lips velvety black. A small spot external to each posterior ocellus, a similar postocular spot on each side and an occasional occipital spot all bright ochreous.

Prothorax black with a large yellow spot on each side of middle lobe, a similar spot on the outer ends of posterior lobe and a large rose-pink spot covering the greater part of dorsum of same lobe.

Thorax black marked as follows:—the mesothoracic triangle rose-pink, extending for more than one-third, but for less than half-way up dorsum of thorax ; a large oval spot of the same colour, pointed at both ends, bluntly so anteriorly, lying between the humeral suture and mesothoracic triangle, but well separated from latter, and of twice its length ; a small upper yellow antehumeral spot, a narrow yellow stripe bordering the upper half of humeral suture behind; a broad very broken stripe on hinder half of mesopimeron and the whole centre of metepimeron golden yellow. Beneath three pairs of yellow spots, the hind the larger, the middle pair obscured. Legs black, the two hinder pairs of tibiæ and femora pruinosed white on flexor surfaces.

Wings long and narrow as in *biforata*, the hind slightly broader than the fore, hyaline in the basal portions, where they are tinted with yellow, opaque blackish brown in the apical areas, the hind bearing here a large vitreous fuliginous spot. Forewings with the outer fourth or more opaque, this area being brilliant coppery or with fiery reflex as in *ignipennis*, with its inner border prolonged slightly basad between costa and *Ri* and running obliquely out towards the hinder border of wing. Hindwing with the inner third opaque and marked with two series of vitreous spots which glow with a coppery reflex, or violaceous, the inner spot always the latter colour. The outer spot produced by a fusion of similar spots to those seen in *biforata*, but often completely or partially divided into two or more spots, lying between *Rii* or *MA* or *Riv+v*, and its outer border on a level with the middle of pterostigma. The inner series composed of 3 vitreous spots similar to those seen in *biforata* but the middle one usually prolonged inwards to fuse with the nodal spot seen in *biforata*. The first spot of this series one row deep by 8 cells long, lying between *IRiii* and *Riv+v*, the middle spot 20-22 cells long when fused with the nodal spot, otherwise only 10 cells long, lying between *IRiii* and *Riv+v*, the hinder spot 11–12 cells long, lying, between *MA* and *Cuii*. Pterostigma black in all wings ; nodal index 12–14 antenodals and 28–31 postnodals in the forewings, 12–14 antenodals and 22-28 postnodals in the hind ; discoidal cell traversed 2–3 times in forewings, 3–6 in the hind; petiolation begins slightly proximad of the 2nd antenodal.

Abdomen black marked with yellow as follows :—segment 1 with a subtriangular lateral spot on each side ; segment 2 with a midlateral stripe, an apical spot and a ventro-lateral stripe ; 3 and 4 similar to 2, but the mid-lateral spot obsolete, whilst 5 has the apico-lateral spot only. All other segments unmarked.

Anal appendages as for genus, the inferiors minutely spined above.

Female. Abdomen 16 mm. Hindwing 22 mm.

(Although so common an insect, and known for so long a time, the female of this insect has hitherto escaped description).

Head. Labium bluish green tipped with black ; labrum black with a large oval or triangular yellow spot on each side ; cheeks broadly yellow, this colour continued up as a narrow bordering to eyes as far back as the level of the posterior ocellus, the basal segments of antennæ, a small triangular spot low down on sides of epistome, two large triangular spots on the upper surface of frons, two transversely oval spots just behind these lying in front and to outer side of anterior ocellus, all yellow ; a small rounded spot on the outer side of each posterior ocellus, a rounded postocular spot on each side and a mid-occipital spot, triangular in shape all bright ochreous.

Prothorax black with a large yellow spot on each side and the borders of the posterior lobe finely yellow laterally.

Thorax as for male but the large antehumeral spot replaced by a fine antehumeral line incomplete above, whilst the mesothoracic triangle is black, finely outlined in yellow, as also the middorsal carina. Legs black, not pruinosed.

Wings entirely hyaline, tinted palely with yellow, the apices narrowly enfumed ; pterostigma black with pale creamy centre ; discoidal cell traversed twice, or more rarely, thrice in all wings ; 12–14 antenodal nervures, 21–27 postnodals in forewings, 19–24 in the hind.

Abdomen black marked with yellow as for male but rather more extensively, thus segments 3 to 5 are marked similarly to 2, and 6 and 7 similar, the remainder unmarked.

Anal appendages and vulvar scale similar to genus.

Distribution. This species is the sole representative of the genus in Southern and Peninsular India. It is a widely distributed insect, thus I have records of its capture in localities as wide apart as Cochin and the Central Provinces. It is common throughout the Palnai, Nilgiri and Shevaroy Hills in the far south, abundant in Coorg, less common at Khandala and Igatpuri on the ghats near Bombay, lastly it is widespread throughout the Agency Tracts and Jeypore on the East Coast. Its exact limits here are yet to be worked out but it probably stops short of Bengal. It is a submontane insect, living and breeding between 2,000 to 5,500 feet altitude Its larva was discovered in the Nilgiris and—was one of the first to be described of the genus. The females congregate on the bare twigs of neighbouring trees in great numbers and are very rarely seen pairing. Occasionally they may be seen ovipositing on a piece of dead twig floating in mid-stream. The males frequently disport in couples before the females, circling and sparring with one another, their white pruinosed legs glistening and thrust out like the arms of a wrestler seeking for an opening. Meanwhile their wings flash like living jewels of fire.

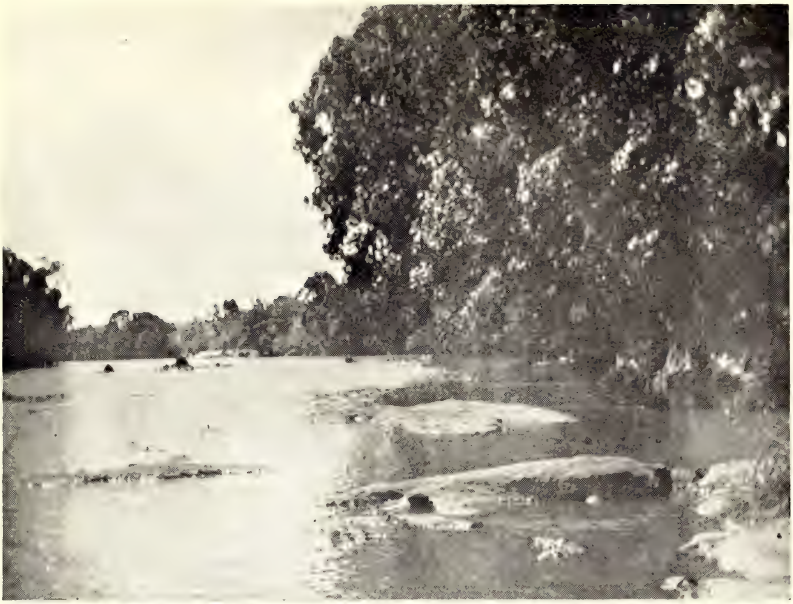

FIG. 1.

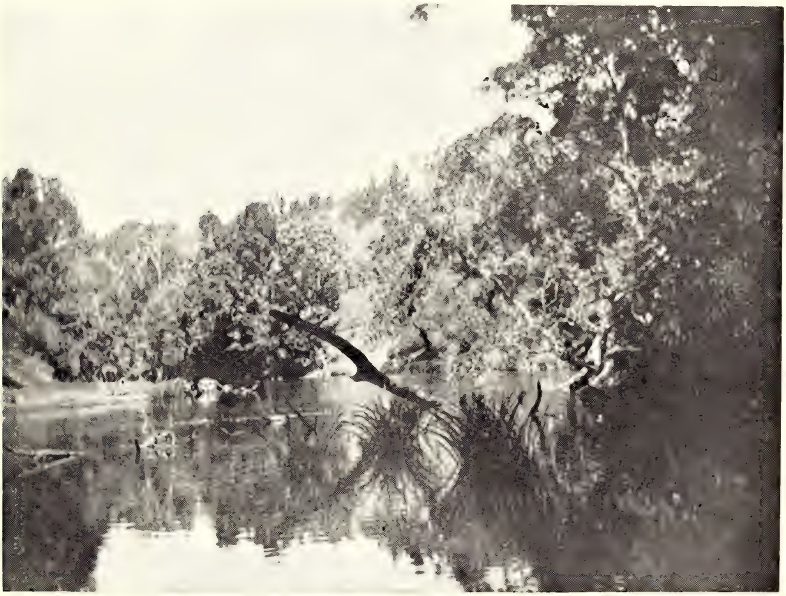

FIG. 2.

1 AND 2. TWO VIEWS OF THE CAUVERY RIVER NEAR FRASERPET, COORG, WHERE *Rhinocypha bisignata* AND *Micromerus lineatus* ABOUND. OTHER DRAGONFLIES TAKEN IN THESE SPOTS WERE *Chloroneura apicalis* AND *quadrimaculata Zygonyx isis, Macromia indica, Macromidia donaldi, Onychothemis testacea ceylanica*, ETC.

Genus CALOCYPHA, gen. nov.

Moderately small but robust insects with characters similar to those of *Rhinocypha*, differing mainly in details of venation and the greater petiolation of wings. Head, thorax, abdomen and legs similar to *Rhinocypha*. Wings equal in length, similar in shape, apices markedly rounded, reticulation more open than in *Rhinocypha*, hyaline with opaque apices; the arc very oblique, lying almost in the same line as the costal border of discoidal cell, the latter shorter than in most *Rhinocypha* and acutely pointed outwardly; petiolation beginning at or well distad of the inner end of discoidal cell; the nervure *ac* situated more basad than in *Rhinocypha*; anal appendages slenderer, the superiors twice the length of segment 10, narrow, cylindrical, curving in at apices which are bluntly pointed, furnished with a few hairs. Inferiors much shorter, half the length of superiors, broad at base, directed directly back and parallel to one another, furnished with a few minute spines on upper surface.

Female with apices of hindwings partially opaque, the venational details as for the male. Vulvar scale and anal appendages as for genus *Rhinocypha*.

Calocypha laidlawi (Fras.) (*Rhinocypha laidlawi*) Rec. Ind.Mus., vol. xxvi, pp. 482, 483 (1924).

Male. Abdomen 17–18 mm. Hindwing 20 mm.

Head black marked with bright vermilion as follows:—a large oval spot on dorsum of anterior part of epistome, a pair of large subtriangular spots behind the former on frons, two large tongue-shaped spots on vertex nearly confluent with former, closely apposed to the ocelli which they partially enclose. The latter spots changing from vermilion to pale ochreous at their hinder ends; a postocular spot on each side of occiput of the same colour. Eyes dark brown; labium pale yellow; labrum glossy black.

Prothorax black marked with creamy yellow as follows:—a narrow anterior collar, an oval spot on each side of middle lobe, a spot on each side of posterior lobe and a large spot on trochanters.

Thorax black, the mesothoracic triangle very narrow, very elongate, extending the whole length of dorsal carina, expanded in its lower third, with parallel sides in its upper two-thirds, bright vermilion red. The central part of alar sinus creamy yellow, laterally the lower parts of sides azure blue save for a small triangular area posterior to the humeral suture and a small linear spot on upper part of 2nd lateral suture. The dark area in front bearing a small upper posthumeral blue spot. Beneath thorax six large rounded yellowish spots, the anterior pair confluent.

Wings hyaline, the bases tinted with yellow, rather less than the apical thirds of all wings opaque black with a dark violety metallic reflex, the margin of this opaque area straight and sharply defined, not bearing any clear vitreous spots or stripes. Pterostigma black, swollen outwardly, oblique at both ends.

Legs black, the flexor surfaces of the two hinder pairs of tibiæ pruinosed white, the same pairs of femora very slightly so.

Abdomen black marked with bright azure blue on segments 1 to 8. Segments 1 to 3 broadly blue on the sides from base to apical border, segments 4 to 8 with a broad wedge-shaped spot tapering apicad but not reaching apical border of segments, gradually diminishing in size from 4 to 8. Segments 2 to 8 with narrow paired basal subdorsal blue lunules. Anal appendages black.

Female. Abdomen 17 mm. Hindwing 24 mm.

Differs from the male by the markings bright pale ochreous instead of vermilion and azure blue, and by its forewings entirely hyaline.

Head black marked with pale ochreous as follows:—two large oval spots on labrum covering the greater part of its surface, the same series of spots on upper surface of epistome and frons as seen in male, the bases of mandibles and a narrow stripe alongside each eye, as far as level of ocelli, the basal segments of antennæ, a small spot on each side of epistome, and lastly, the same postocular spots as seen in the male.

Prothorax similar to male but the middorsum bearing a stripe which runs from posterior lobe nearly to anterior end of prothorax.

Thorax black marked with greenish yellow as follows:—two minute spots on the antealar sinus, the middorsal carina finely, a fine antehumeral stripe, its anterior end curling abruptly outward, a short posthumeral stripe, incomplete below, a still shorter vestigial stripe just posterior to the upper part of first lateral suture, a long stripe traversing the whole length of sides, crossing both sutures obliquely, its upper and lower borders very irregular and serrate.

Legs black, femora a dirty yellow on inner sides.

Wings hyaline, the hind with the apices broadly brown as far proximal to the inner end of pterostigma as its own length, and of a much deeper tint in the hinder two-thirds of wing. Anteriorly the cell-middles are hyaline, whilst at the apex of wing, the brown area is replaced by a small opaque white area. Pterostigma with inner half black, outer half whitish margined with black. Antenodal nervures 10 to 11 in forewings, postnodals 18 to 19 (10 to 11, and 18 to 24 in the male) ; discoidal cell of forewings traversed once only, rarely twice, in both sexes, 2 to 3 times in the hindwings. Petiolation beginning at inner end of discoidal cell in the female.

Abdomen black marked with bright ochreous and greenish yellow :—segment 1 with a large lateral spot and a minute middorsal linear apical spot, all segments from 2 to 8 with the middorsal carina finely yellow and from 2 to 7 with a long narrow stripe followed by a large apical spot on each side, whilst beneath this marking, on all segments, is a superventral stripe ; remaining segments unmarked.

Anal appendages black, long, acuminate. Vulvar scale as for genus.

Distribution. Confined to South Kanara, to the net-work of rivers about Sulia. I well remember the first discovery of this beautiful insect, when in company with Mr. C. A. Souter, I was making my way up the bed of the river in the Coorg—S. Kanara enclave. We had come to a fork in the stream and agreed to part company, each to work his own branch of the fork. Shortly afterwards I came on my first specimen which I mistook for a *Pseudagrion rubriceps*. Its size and conspicuous colouring led me however to glance at it a second time, when I at once recognized that it was something altogether new. I took eight males in all and when I rejoined my fellow shikari, found that he too had made the same discovery, having taken four more males (Nov. 9, 1923). Mr. Souter discovered the female on this same river in the following April, where I again found it later. For a long time, the discovery of a second species of *Rhinocypha* in South India has been visualized by Dr. Laidlaw and myself, so that it was very gratifying to come upon this insect. Dr. Laidlaw has pointed out to me the marked differences in venation and has suggested the removal of the insect from genus *Rhinocypha*, a suggestion here carried out. The type and co-type in the British Museum. Paratypes in the Fraser, Ris, Laidlaw, Morton, Pusa and Inglis' collections. The insect is a shade lover, albeit its bright colouring. It is found perched on half-submerged logs in midstream, or resting on twigs overhanging the river. The reds and blues are very conspicuous when the insect is in flight, whilst the black tips form an almost complete circle round it as the wings whirl with cinema effect.

Genus, LIBELLAGO, Selys.

Selys, Syn. Cal., p. 57 (1853) ; Id. Mon. Cal. p. 226 (1854) ; Walk. List. Neur. Ins. Br. Mus. vol iv, n. 643 (1853).

Moderately robust insects with characters very similar to genus *Rhinocypha* but differing less from that genus than does *Calocypha*.

Head, thorax and abdomen similar to *Rhinocypha*, but mesothoracic triangle undeveloped and uncoloured ; the abdomen, on the other hand, of the males, usually brilliantly coloured. Wings entirely hyaline in both sexes, narrow, the hind not noticeably broader than the fore, venation close, similar to that of *Rhinocypha*, except *MA* which is more or less zig-zagged for at least the outer part of its course, so that the cells bordering it are pentagonal instead of rectangular as in *Rhinocypha ;* petiolation ends well proximad of the inner end of discoidal cell. Legs variable, similar to *Rhinocypha* in the single Asiatic representative, similar to *Rhinocypha*, or widely dilated, in African species and usually brilliantly coloured. Anal appendages and genitalia very similar to *Rhinocypha*.

Distribution. Only a single species has been recorded from Asia, *L. asiatica vittata*, which extends through Burma and Tonkin, to the Philippines where it is represented by *L. asiatica asiatica*. The genus although so closely allied to *Rhinocypha*, is essentially an African one, and it is doubtful whether *asiatica* should be included in it, as the venational differences seperating it from *Rhinocypha* are not nearly as marked as they are in the African species of the genus, nor is the abdomen marked as brilliantly as in the latter. The Asiatic species may be regarded as a link bridging the gap between the two genera, and raises a point of profound interest as to how, when and where the passage took place. Genotype—*Libellago dispar* Beauv.

Libellago asiatica vittata Selys, Ann. Mus. Civ. Genov. (2a), x, (xxx), pp. 58, 59 (1891); Will. Proc. U.S. Nat. Mus., vol. xxviii, p. 173 (1904); Mart. Mission Pavie, Neuropteres (sep.), p. 17 (1901); Laid. Rec. Ind. Mus., vol. xiii, pp. 39, 40 (1917).

Male. Abdomen 23 mm. Hindwing 33 mm.

Head black unmarked; prothorax black unmarked.

Thorax black with a fine posthumeral yellow stripe and two oblique dark ochreous bands on the sides. Legs black.

Wings hyaline suffused with brown at extreme bases, especially in the subcostal and median spaces as far as the basal antenodal nervure; 16 antenodal nervures, 19–22 postnodals in forewings, discoidal cells traversed twice or thrice; pterostigma black, about 2 mm. in length.

Abdomen black marked with reddish brown, segments 1 and 2 entirely black, dorsum of segments 3 to 8 reddish brown, the sides yellow, as well as the dorsal carina finely; apices of segments narrowly, and the whole of segments 9 and 10 black. Anal appendages black, superiors twice as long as segment 10, slender, curving in towards their apices which are a little spatulate; inferiors cylindrical, separated, curving in at apices, about half the length of superiors.

Female. Abdomen 20 mm. Hindwing 30 mm.

Head. Labium black; labrum black with a large diffuse rounded central spot of pale yellow; bases of mandibles, a large spot on the sides of epistome, another on the sides of frons, the basal segments of antennæ, the cheeks broadly, a small oblique spot on the outer sides of the posterior ocelli and a rounded postocular spot on each side of occiput pale creamy yellow.

Prothorax black, the lateral ends of posterior lobe and a large spot on each side of middle lobe pale yellow.

Thorax black marked with a pale greenish yellow antehumeral stripe incomplete above, where however, is an isolated spindle-shaped spot of ochreous; a bright ochreous elongate posthumeral upper spot, at the lower end of which, and on the dorsal side of the humeral suture, is a somewhat smaller triangular spot; laterally the whole of the lower half of mesopimeron, and the whole central portion of the metepimeron as well as a small curved stripe behind the upper part of the first lateral suture bright ochreous. Beneath thorax a broad transverse stripe behind the legs, followed successively by a large arrow-head shaped spot and a broad terminal stripe all ochreous.

Legs black, coxæ and trochanters yellow, proximal ends of all femora yellowish brown.

Wings hyaline, the extremity of all apices clouded narrowly with blackish brown; 15 to 16 antenodal nervures in forewings, and 17 to 18 postnodals, 16 antenodals and postnodals in hindwings. Discoidal cells traversed thrice; the nervure *ac* well proximad of inner end of discoidal cell; petiolation beginning at level of 2nd antenodal; pterostigma blackish brown, longer than in male.

Abdomen black marked with yellow as follows:—segments 3 to 8 with a narrow middorsal carinal stripe, segments 1 to 7 with the sides broadly yellow, this colour expanding dorsalwards at apical ends of segments; segment 8 with a rounded apico-lateral spot.

Anal appendages black, long and narrow, pointed. Vulvar scale as for *Rhinocypha*, black with a large medio-lateral bright yellow spot.

Distribution. Bhamo, Burma, within Indian limits, June and July. Reported also by Martin from Tonkin. Type in the Selysian collection. Appears to be a rare insect wherever taken.

(*To be continued.*)

Note :—In part xxvii, Indian Dragonflies of this volume, by a printer's error, the figures have been transposed. Fig. 1 should be Fig. 2 as regards the explanatory text, and *vice versa*.

A SIND LAKE

BY

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(With six plates and three Text figures)

This is the narrative of a delightful New Year week spent on the Manchar, perhaps the largest fresh water lake in India, and certainly the most enthralling from the point of view of the sportsman and ornithologist.

Situated in the Larkana District, the Manchar, like all the other numerous *dhunds* (*jheels*) of Sind, owes its existence principally to the annual inundations of the river Indus. A portion of the Indus waters reaches the Manchar by a natural and very tortuous channel known as the Western Nara, and again finds its way back to the parent river through another—the Aral. This latter commences at a point near the dusty little town of Sehwan whose chief pride at the present day lies in the dilapidated ruins of a mud-and-brick fort claiming an abstruse connection with the invasion of Alexander the Great, and in the annual fair held at the *dargah* of a *pir* long-defunct but who continues to perform his miracles notwithstanding.

The Manchar, in other words, may be regarded merely as a local expansion of the Western Nara Canal; during inundations when the level of the Indus rises much higher than that of the lake, the Aral discharges water into the Manchar; when these floods subside, the current is reversed and the water carried back to the river. A vast expanse of land—20,000 acres or more—is exposed by the post-monsoon drying or draining off of the lake which is extremely fertile and valuable for the cultivation, of *rabi* crops such as wheat and gram. It is these cultivations, incidentally, that afford attractive pasture to the innumerable hosts of geese and cranes which constitute such a salient feature of the bird-life on this wonderful lake.

Unfortunately for the bird-lover, by reason of this very fertility of the soil left high and dry by the retiring floods, the days of the Manchar as a wildfowl resort are numbered. A mammoth scheme is afoot for draining off the lake more or less completely in the cold weather so as to render the greater part of its bed available for cultivation. The disappearance of these extensive feeding grounds will doubtless produce a marked effect on the bird-life not only of the district but of the province of Sind as a whole, especially as the project is expected to come into operation simultaneously with the mighty Sukkur Barrage and its intricate network of canals, with the consequent opening up of enormous tracts of hitherto unpopulated country.

As a whole, the waters of the Manchar are shallow, ranging from a few inches in depth to eight or nine feet. The surface of the marginal shallows is covered with tangles of the floating lotus plant (chiefly *Nymphœa lotus* and *Nelumbium speciosum*) which grow in unbounded profusion in every *dhund* in Sind. These in the Manchar yield a considerable revenue to Government. The roots of both, called *Lorh* and *Beeh* are extensively used as food, as a substitute for potatoes and in many other forms—whilst their seeds or nuts (*Nâpo* and *Pâbûro*) are also much eaten and sold in the bazaars.

Apart from these littoral lotus tangles, the shallows abound in reeds and sedges affording ideal shelter to countless myriads of wildfowl of every description which, driven by the bitter cold and scarcity of food from their northern homes, migrate southwards and find an agreeable haven in their hospitable seclusion.

We were encamped in the District Local Board bungalow at Shah Hassan, a tiny village on the western shore of the Manchar, between its waters and the desolate looking Kirthar Range which forms the natural boundary between Sind and Baluchistan. The road to Shah Hassan from our last camp ran for a good way by the margin of the lake, and all along in the distance could be descried millions of waterfowl, floating on the water lumped together, looking like immense floating islands, while the terrific honking, quacking and 'spattering' set up by the birds sounded like the distant grind of some weird machinery. Every now and again there passed over or in front of us within distinguishing range, flocks of various species of duck, and skeins of Grey Lag Geese leisurely winging their way lakewards from the direction of the Kirthar where they retire nightly to feed on the beloved grit which the hills supply.

A chronicle of one of these memorable days spent on the lake will suffice as sample.

We left the bungalow soon after daybreak in punts, each punt manned by one gun, a shikari and three *mohanas* with poles. The mohanas or 'mirbahrs' (literally 'sea-lords' or 'Admirals' !) are Mohomedans of what one may call an amphibious species. They spend their lives on or near the River Indus or one of the numerous *dhunds* created by its monsoon inundations, and eke out a bare livelihood by plying boats, gathering lotus seeds and roots, fishing and capturing wildfowl in a number of ingenious ways, some of which are hereafter described. Some of the more enterprising ones also go in for farming egrets, an industry which holds much promise when the traffic in plumes is legalized. Fatigue is a thing unknown to these 'sea-lords' and it is remarkable how they will go on punting almost incessantly all day without exhibiting any symptoms of it.

We glide placidly over the limpid waters in the direction of the butts that have been prepared overnight in the neighbourhood of a bank where Grey Lag Geese have been observed to congregate in the mornings before repairing to their favourite feeding grounds among the tender gram and wheat fields hard by the margin of the lake. A piercing north-easterly wind is blowing which strikes our faces like needles, and pierces through great-coat, tweed jacket, and thick Jaeger vest to the very marrow of our bones. We sit on the bow of our punt with our heads snugly buried to the ears in the collar of the trusty great-coat and our hands thrust well down its grateful pockets. In our course, we disperse immense flocks of coots, with which are mingled odd parties of gadwall and other species of duck. The Manchar is, and has long been, notorious for the masses of coots it harbours, but their numbers are totally inconceivable until you actually see them and can believe your eyes. Great patches of the lake are literally blackened with their multitudes and their ' spattering ' on the water as they attempt to rise, is positively bewildering to the new arrival. Inspite, however, of the wholesale slaughter and destruction that proceeds apace from the time the coots arrive till their return migration at the commencement of the hot weather, their numbers appear to remain unaffected, and the legions that visit the country again the following season show that the coot is one of those fortunate species that is in some way exceptionally well-fitted in the struggle for existence, and stands in no immediate danger of extinction.

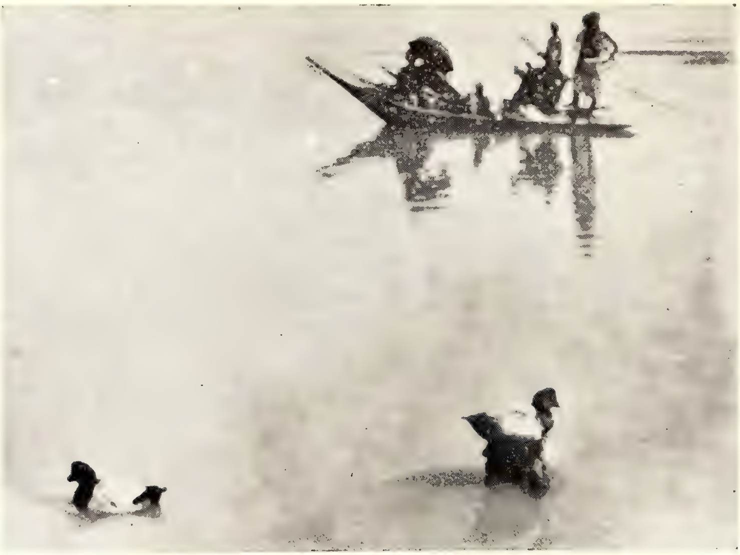
But to continue with our narrative. Owing to exceptionally heavy inundations of recent years, the greater part of the thicker reed-beds on the Manchar which erstwhile provided such admirable cover to the sportsman have disappeared, rendering satisfactory sport none too simple a proposition. The butts or ' hides ' in the present instance consisted of a few twigs of tamarisk thrust into the lake-bed to conceal the punts, there being no natural cover at hand. These were arranged in a row at distances of 40 yards or more from each other. We soon take up our positions, and at a given signal the drive commences. Some of the punts have gone ahead to round off the birds, while others are stationed at a distance in the rear to turn the birds back over the guns. The first to take alarm are a party of Pintails—all males keeping together. They fly low and unsuspectingly over the central ' hide ' from where the right rings out, followed by the left in quick succession. These are accommodatingly responded to by splashy thuds as two of the fat birds pay the penalty of blissful ignorance. The flock breaks up to right and left at lightning speed, and the birds lose no time in rising well out of range.

The reports of the gun rouse the other habitués of the lake into action and now follows a sight that can never be forgotten—a sight that must leave an indelible impress on the mind of every sportsman who shoots on the Manchar. The birds rise in their thousands to the accompaniment of a veritable babel of flapping, swishing, spattering, honks, quacks and a variety of other noises. Now come the pochards and the shovellers, spotbills, mallard and teal all in a jumble, some swishing past in orderly flocks overhead, others flying singly or in twos and threes. The clouds of mixed species that rise, soon resolve themselves into little parties of their own. Unfortunately the wind keeps up and spoils the fun. The birds get steadily higher and higher and are soon quite out of range. Our gunners have been feverishly active all this while, and the firing has been fast and furious. The average of kills however, dwindles off appallingly after the first few fusilades, and in the later stages of the shoot the sportsman has to rely more upon his luck than on his skill.

In a very short time the birds have disappeared. The firing now becomes sporadic and far between as an occasional mallard or white-eye returns blundering past to reconnoitre ground so lately

1. NEGOTIATING THE REEDY MARGINAL SHALLOWS.

2. NEARING THE BUTTS.
(Note masses of wildfowl in the background).



3. THE FOWLERS LEAVING THE PUNT.

4. THE FOWLERS ABOUT TO ENTER A FLOCK.

evacuated. Very good sport may sometimes be had at this stage, as the gunner need be in no hurry, and the tendency to 'brown' flocks, which is perhaps the most important cause that contributes towards unsatisfactory averages, is eliminated.

None of the Grey Lag Geese which formed such an imposing array on the mud-banks in our front have come our way during the drive except a pair, of which one fell and the other was disgracefully missed. During operations, a great many skeins have been noticed flying over, well out of range, in the direction of the young wheat and gram on the farther margin of the lake. The masses that rose at the first shot have also made a bee-line for these parts. A hasty confab of the shikaries decides that our acquaintance with the birds might be renewed with advantage, and we push off. All the way in the punts, flock upon flock of the geese are observed leisurely winging their way towards their rendezvous flying studiedly out of range and frankly disdainful of our murderous aspirations. Notwithstanding the obvious, the more enthusiastic section of our party have been totally incapable of restraining the trigger-finger. On the universally accepted and sound principle that accidents *will* happen in the best regulated households, the Mannlichers are brought into action, but magazine after magazine has failed to disturb the complacence of the assaulted, who doubtless regard it all as a rather meaningless and totally unnecessary demonstration on the part of the human biped.

True, one 'accident' did happen. A stray bullet caught the leader of a wedge plumb in the centre of his fat body blowing his back completely away, and the bird arrested dead in his flight as if by a stroke of heart failure, hurtling down like a stone through 500 feet or more of space presented a remarkable spectacle. This event of course roused hopes which conduced to dissipate ammunition in the shortest possible time!

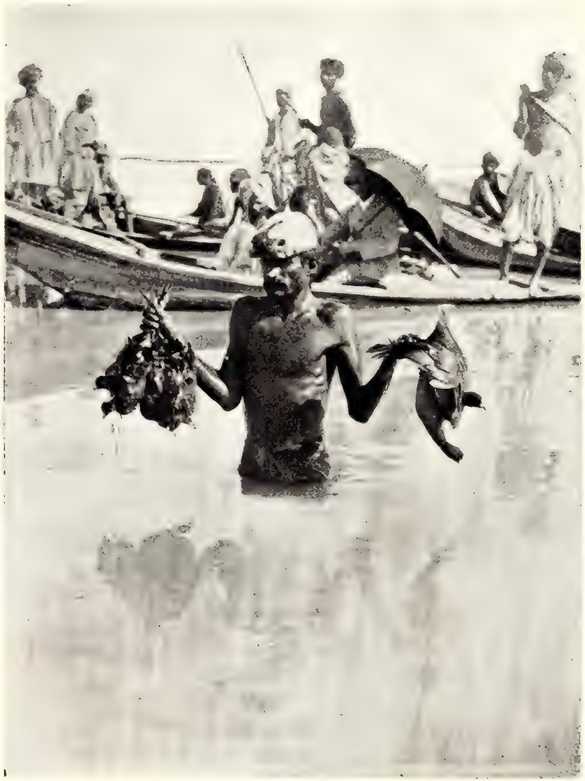
In an hour we are on the farther shore. Punts are discarded and a rigorous tramp of about three miles over slushy ground brings us within reach of our objective. By the time we arrive at our destination it is 10.30. The distant fields, as far as the eye can reach, are one seething mass of jostling Grey Lags, but the total absence of suitable cover presents a problem. The shikaries however are up to the game. They put their heads together and we soon find ourselves hustled along to within a few hundred yards of the birds—now crouching, now crawling on all fours, now halting motionless then again running cautiously forward taking the fullest advantage of every unevenness the ground offers. Here we are made to squat behind diminutive tussocks of grass in ankle-deep water, all in a line at intervals of a hundred yards or so. The beaters who have gone ahead in the opposite direction, seeing us safely ensconsed, commence walking towards the birds. The foremost to scent trouble are the odd parties feeding on the outskirts who rise, as often as not to settle again after circling the fields. When the men have managed to edge themselves more or less into the centre of the congregation, the shout is raised. The sight that now ensues completely baffles description. Momentarily your horizon is obscured by dense masses of Grey Lag Geese and the din of their honking is such as to render the various excited injunctions of your shikari positively inaudible. The birds spread themselves over a vast front. The guns have been placed directly in their line of retreat to the lake, and you presently see a few thousands coming your way. You crouch and prepare to send up your greetings, cylinder and choke, but before you have been able to gauge the range, the great multitude have swept over, and now come smaller skeins which happily are flying lower. You hear shots from your neighbours and occasional heavy splashes in response. The birds swerve to right or left, but before they can rise much higher they are directly over you. If you remain cool and collected and pick out your birds before firing, a couple of rights and lefts will bring you two brace without difficulty. If ambitiously inclined, however, and aspiring to a record bag by 'browning' the flock, you will as likely as not be left cursing your stars with a clear blue sky above and precious little to compensate for it in the nature of birds in hand!

This briefly is the typical programme of a day's shooting on the Manchar, which with sundry variations may be experienced by all sportsmen who shoot on the lake.

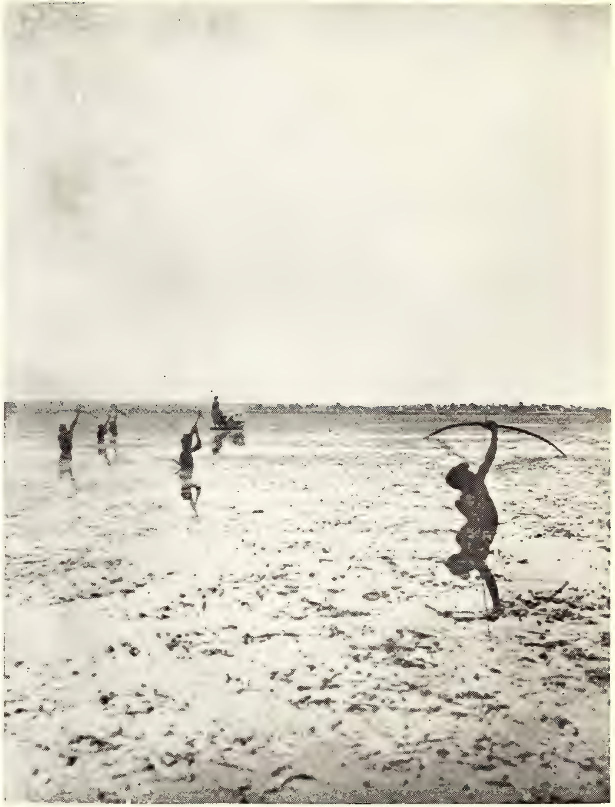
A couple of days were spent in watching the wildfowl netting and fishing operations of the mohanas, which proved both enjoyable and instructive.

The flesh of the coot, though somewhat rank and fishy to 'sophisticated' palates is held at a premium by the Sindhi, especially of the poorer classes. He prefers it to duck and other wildfowl, and the coot accordingly is a coveted object of the mohana's attentions and devices.

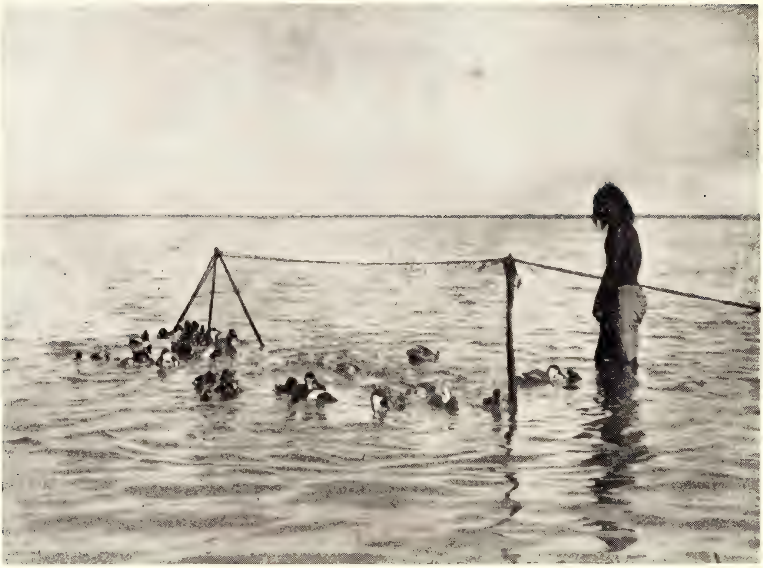
There are numerous little villages and hamlets by the shores of the Manchar and most of the larger *dhunds* in Sind, the inhabitants of which subsist throughout the cold weather months either on the flesh of this unfortunate bird or otherwise by the wherewithal provided by traffic therein. In the neighbourhood of every such village may be seen masses of coots' feathers which bespeak the sad fate of the many gone before. Coots sell in the villages at about two annas a piece, and owing to their ready demand, bring brisk business to the fowler. A very common method of capturing the birds is for a man to wade into the shallows frequented by the coots, wearing on his head in the form of a cap, the complete skin of a duck with head and neck properly set up, and provided with breathing and eye-holes for the fowler. Under cover of this deception he stalks gradually up right into the midst of an unsuspecting flock, nothing visible except the harmless looking decoy on his head. When well within the assembly, the fell work commences. A bird is grabbed by the leg under water and in the twinkling of an eye, before it has time to flutter, the victim disappears below the surface. Its legs are bound up with water weeds and the captive firmly secured to a belt round the fowler's waist. The other members of the flock have noticed nothing of this foul treachery, and are as confiding as before. Presently a second bird disappears, a third follows rapidly, and then a fourth. Shrewd suspicions now begin to cross the minds of the silly coots and misgivings become apparent as to things being as they should; there is certainly something



5. A SUCCESSFUL CATCH.



6. THE *Gazis* IN ACTION.

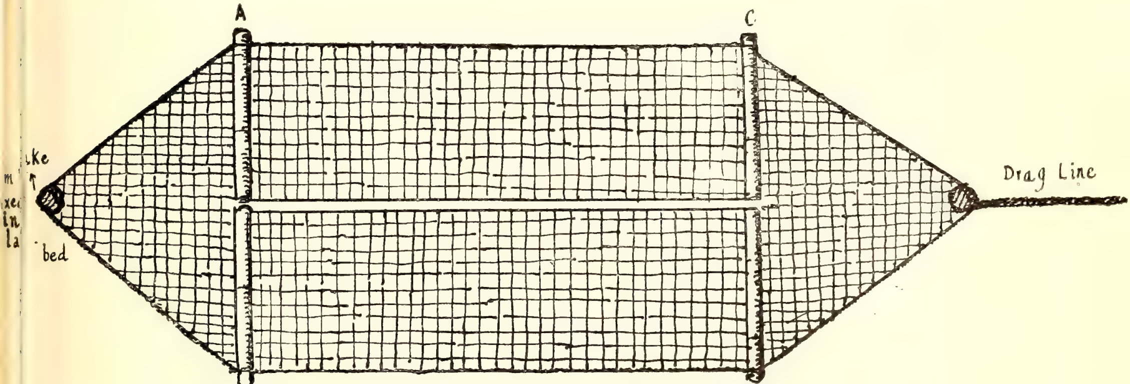


7. RED-CRESTED POCHARDS IN A *Dhubbi* NET.

8. REMOVAL OF CAPTIVES FROM *Dhubbi*.

wrong somewhere! A number of the birds spatter away some distance from this mysterious duck, but are too dense however to detect that unlike other self-respecting ducks, this one of their suspicions that follows steadily, progresses backwards or sideways! The eye- and breathe-holes for the fowler are placed near the vent and undertail coverts of the skin, so that the decoy and the man below are facing in opposite directions! When the fowler has gathered half a dozen birds or so below the water, he fastens their legs together and moving off some distance from the flock, he allows his ring of captives to come to the surface for breath. It not infrequently happens that when sport is good and the fowler ambitious, some delay occurs in this very necessary operation with the result that several of the hapless prisoners are drowned. Leaving the knot of captured birds on the water, the wily mohana again sidles into the flock and the process is repeated. Thus it is not unusual for twenty or thirty birds to be taken by a single man in the course of a morning's work. Duck are also taken in this manner, but the stupidity of the coot lends itself particularly to this device, and they make by far the more ready victims. By way of a variation, in place of the duck-skin cap a tame cormorant is frequently perched on the man's head, and the bird appears to participate whole-heartedly and to enjoy the sport thoroughly. This method of fowling is of great antiquity and has been pursued through the ages practically unchanged in every detail. It was greatly in vogue in the time of the Emperor Akbar.

A method of netting wildfowl on a somewhat larger scale is known as the *Dhubbi*. Here a net, about 30 feet × 20 feet is stretched on the shallow bed of the lake at a favourite feeding ground of the birds. A quantity of grit from the neighbouring barren hills is sprinkled over the net by way of bait. A drag-line, 200 yards or more, is attached to one end of the net by the pulling of which the net closes up in the form of a Gladstone bag.



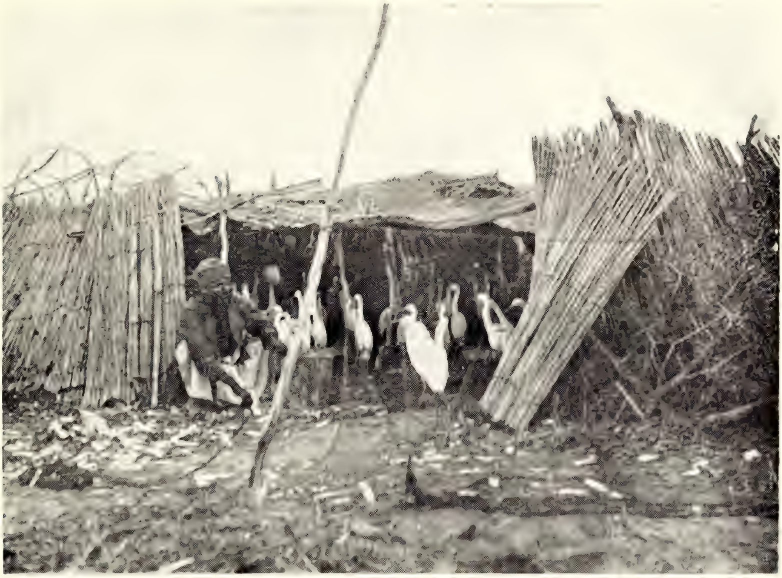
Open "Dhubbi" Net
When net closes A meets B and C meets D.
Fig. 1.

The fowler with the loose end of this line conceals himself and his punt among the reeds at a distance and keeps a vigilant look-out. While 'tipping' about for food, the presence of the grit is discovered by the birds and this marks a general scramble for the spot within the sphere of influence of the hidden net. Now is the time for the fowler to get busy: the line is pulled steadily and gradually till one final and mighty heave leaves the birds entangled. One of my photos shows thirty-five Red-crested Pochards taken in a net of this size. The fowler now approaches, and removing one captive after another, proceeds in the most matter of fact manner to interlock their wings—twisting one wing round the other over the back—and to dump the birds mercilessly into his punt prior to packing them up in crates for despatch to Karachi and other markets.

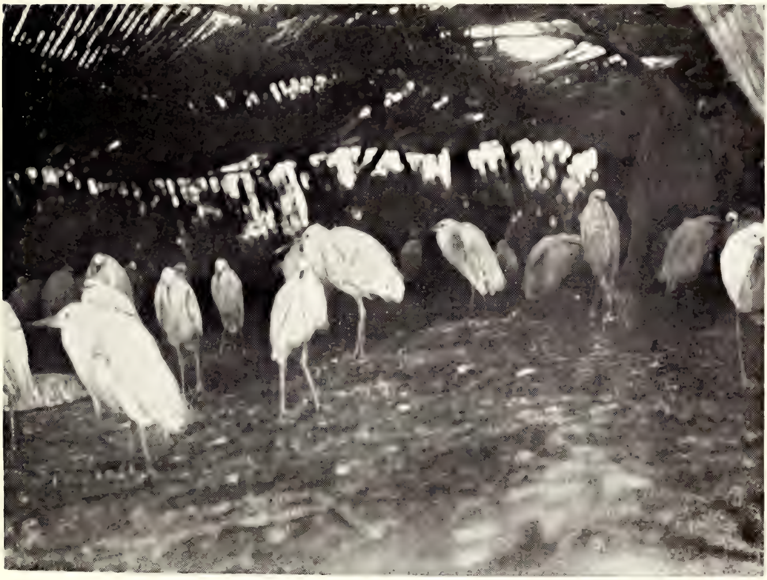
On a vaster scale, and for business on wholesale lines, the *modus operandi* of the mohanas is as follows :—

A flight-net about 12 feet high and a quarter of a mile or more in length is stretched on upright poles across a portion of the lake in the proximity of some favourite feeding ground, with due regard to direction of wind, etc. This net is turned up at the bottom, just below the water-line, to form a continuous bag running all along the the lower border. A quantity of the beloved grit is dropped along the length of this net. Ducks, geese, coots and other wildfowl gather in their hundreds to feed on this spot at night, and under cover of the darkness a number of punts move up in line formation from the opposite direction collecting and driving the unconscious birds towards the net. When the punts have advanced to within thirty yards or so of this 'barrier of twine', a signal is given and a terrific uproar set up. Lighted faggots and torches are all of a sudden hurled at the birds who rise in distraction and attempt to flee in the opposite direction. Before they are able to get well under way and rise high enough to clear the cryptic net, they dash into it headlong to be thrown down fluttering into the gaping bag below, whence they are soon extracted by the mohanas who hurry forward anon. In this manner a thousand or more birds may be taken in the course of a single drive.

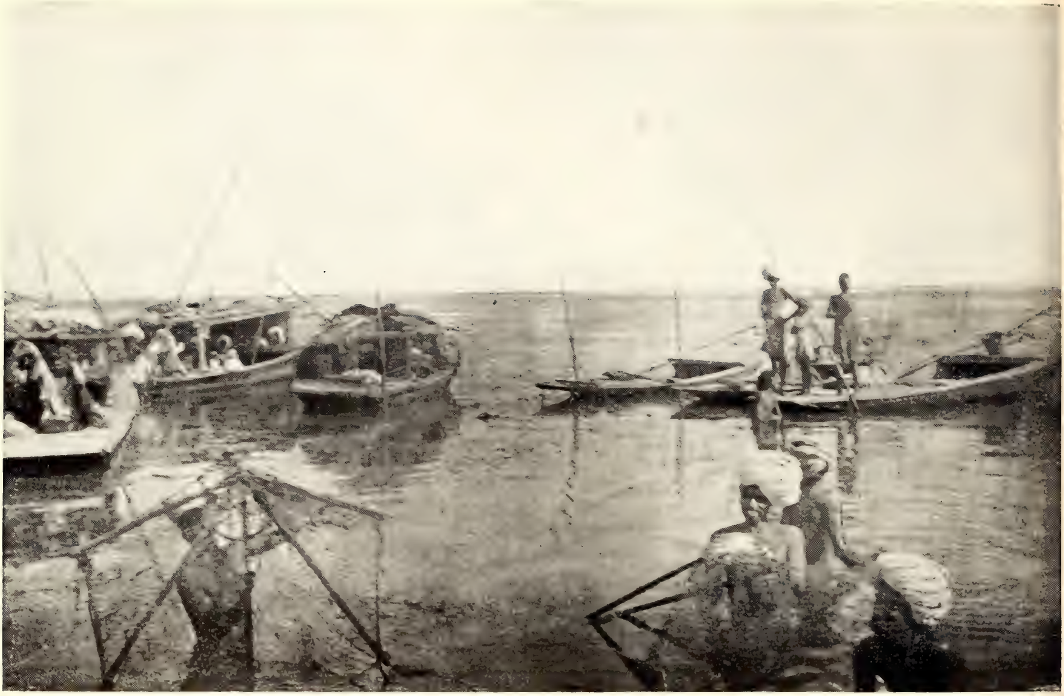
A rather sporting method of procuring coots for the pot is frequently indulged in by the mohanas. The gadgets employed in this sport are a powerful bow made of bamboo and a number of blunt, headless, unfeathered arrows, about three feet in length and three-quarters of an inch thick. The hunters approach a flock of coots in punts and divesting themselves of their clothing to very nearly the irreducible minimum, launch into the waist-deep water where they crouch submerged up to their chins in a row at intervals of fifteen yards or thereabouts. The punts move off to round up the birds and drive them towards the bowmen or *Gazīs* as they are called. For some time the coots continue to swim away from the advancing punts and in the direction of the archers, but on being pursued closer, they attempt to rise. They spatter along the surface before taking off, and by the time they are over the line of bowmen they are scarcely higher than fifteen or twenty feet. The men who have hitherto been immersed to their chins with bow and arrow in readiness under water, suddenly pop up and discharge their



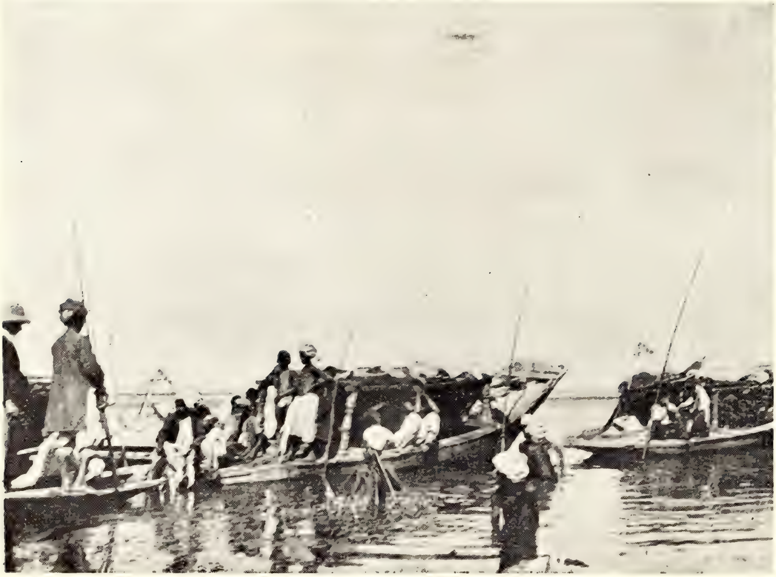
9. AN EGRET FARM ON THE MANCHAR.



10. INTERIOR OF THE SAME.



11. FISHING ON THE MANCHAR—LANDING THE CATCH.



12. ANOTHER SNAP OF THE LANDING OPERATIONS.

missiles. The arrows strike the birds crosswise, i.e., on the flat, and often with such force as to take a wing clean off. The men are such adepts at the game that misses are a rare occurrence, and a volley from half a dozen bowmen seldom accounts for less than four or five birds.

The mohana's methods of fishing also afford interesting watching, and the industry and hard labour entailed by some of the less wholesale systems leave one in strong doubt as to whether after all the zeal displayed is not worthy of a better cause! He will spend the best part of a morning—his family in full strength participating—rocking his boat from side to side and creating the most deafening and unholy row with tom-toms and copper 'dekchies' in attempts to drive the fish into the nets he has put up at a distance, and when everything has gone off well and 'according to programme', he will pull out a single fish or sometimes a couple—a catch not worth more than four annas!

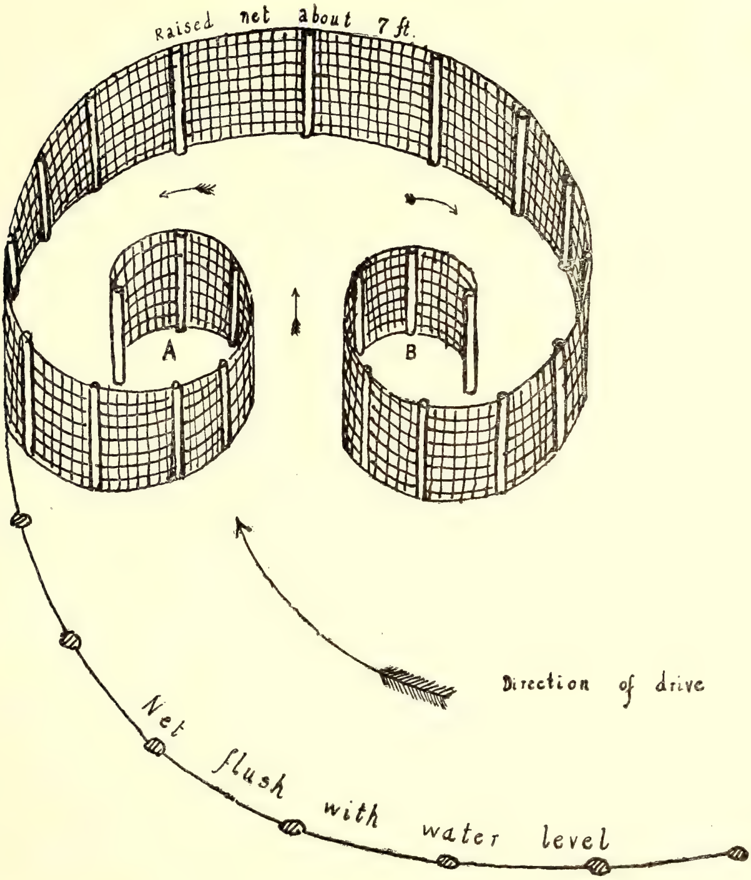


Fig. 2

In one of the methods most commonly employed, the nets are arranged as shown in Figure 2.

The fish are finally driven into the enclosed spaces marked A and B whence the mohanas land them by diving, or if the water be shallow, by means of a hand net like the one shown in the photo (No. 11.)

The most important fish of Sind is the *Pala* (*Clupea ilisha*). It is a sea fish belonging to the same genus as the herring, and ascends the Indus in the months of February and March for spawning in enormous numbers. For a short period at this time, this species fairly swarms the Manchar. Next in importance come the *Dambhro* (*Labeo rohita*) which may grow to a length of three feet, and the *Mori* (*Cirrhina mirgala*). Two specimens from the lake sent to the Indian Museum, Calcutta, have been identified by Dr. S. L. Hora as these species.

When the catch is not large enough to warrant its being carried to market, the fish are kept over till the next day, the day after, or even longer. The mohana, on withdrawing a fish from the landing net, probes deep into the animal's side just below the spinal chord with a large skewer-like needle. Having thus paralysed his captive, he proceeds in the most callous manner imaginable to drive this same needle threaded with twine through one eye-socket and out through the mouth. The fish along with other hapless ones is now secured to the punt and the bunch is left floating listlessly on the water in a comatose condition till gathered in and carried off to market. It is thus that the mohana always manages to supply ' fresh fish '!

Apart from duck-shooting, which is *par excellence* the sport of Sind in general and of the Manchar in particular, by far the most engrossing charm of the Manchar lies in the unequalled variety of bird-life it presents. I mention only a few of the species met with in the course of a day's casual observation when the main object was shooting. This is only a very small fraction of the species I was able to recognize, and in addition there were a host of others which could not be identified for obvious reasons.

Flocks of Starlings, chiefly from five to twenty birds but sometimes hundreds, kept about the margins of the lake feeding on the semi-marshy grassland whence the water had lately receded. A specimen obtained proved to be *Sturnus vulgaris nobilior.*

Wagtails were plentiful, both along the margin of the lake and in the shallows overgrown with the lotus plant, where they could settle on and hop about from one floating leaf to another. The commonest species—specimens of which were secured and have since been identified by Dr. C. B. Ticehurst—were : (1) The Indian White Wagtail (*Motacilla alba dukhunensis*) ; (2) The Blue-headed Wagtail (*M. flava melanogriseus*) ; and (3) The Yellow-headed Wagtail (*M. citreola*).

The Pied Kingfisher (*Ceryle rudis leucomelanura*) was perhaps the commonest kingfisher. Seen mostly in parties of four or five. Extremely pretty to watch as he hovers stationary over the water and hurls himself head foremost at some unsuspecting fish from a height of fifteen to twenty feet. The small *Alcedo atthis pallasi* was also not uncommon. His tactics as a general rule differ from those of his pied cousin. He sits on a branch rarely five or six feet above the surface and drops perpendicularly on a passing fish with which he flies off to a neighbouring perch.

The Indian Purple Moorhen (*Porphyrio poliocephalus poliocephalus*): This bird was an extremely common frequenter of the reed beds, where it must breed. An immature male was caught by the mohanas by surrounding a patch of reeds in which it had taken refuge, being unable to fly well. It looked lean and lanky. The iris were brown; bald patch on forehead and bill black, slightly reddish on lower mandible. Legs and feet pale orange brown.

Coot (*Fulica atra atra*): As mentioned before, this is without doubt the most abundant species on the lake. Besides the incessant ravages of man, a great many fall victims to the numerous species of accipitrine birds that ceaselessly beat over the waters of the *dhund*. I was the fortunate witness of a raid on a flock of coot by a large eagle, the species of which I was unable to ascertain owing to the distance. It was I think either the Imperial Eagle (*Aquila heliaca*) or the Large-spotted Eagle (*Aquila clanga*) both of which were common about the locality. The plan of attack was interesting. The eagle swooped down on the compact flock (about 200 birds) and in this first bout broke it up. Several of the coots spattered off, some dived below the surface while others swam away as fast as possible from the scene of assault. The eagle renewed the attack three or four times, till, having made confusion worse confounded, it succeeded in isolating from the flock an individual which promptly dived. This was the assailant's opportunity. After a couple of unsuccessful stoops, whenever the coot appeared on the surface for breath, the eagle bore down on him like a hurricane and carried him away in his talons.

In this particular case I was able to notice nothing of the singular manner, often described, in which coots are said to defend themselves against eagles. It has been recorded that on the appearance over them of one of these birds, the coots collect in a dense body and when the eagle stoops at them, they throw up a sheet of water with their feet and completely baffle the enemy.

No cranes, neither *Megalornis grus lilfordi* nor *Anthropoides virgo*, were seen. I was informed that it was as yet somewhat early for them and that they swarmed the localities, especially round our latter camp, Janghar, in January and February when the crops were fully grown.

White-tailed Lapwings (*Chettusia leucura*) were fairly common along mud banks, feeding in companies of four or five birds.

The Black-tailed Godwit (*Limosa limosa limosa*): This bird was extremely abundant on the shores of the lake near Shah Hassan. Their numbers must run into tens of thousands, and large patches near the margin of the water were literally obscured by their multitudes.

The Caspian Tern (*Hydroprogne caspia caspia*): Numbers of this beautiful tern were seen flying over the lake. When one of the specimens I shot dropped into the water, it was immediately swooped upon by a Marsh Harrier (*Circus æruginosus*) which is perhaps the most numerous species of the Accipitres about the lake. This bird was also secured.

The Black Ibis (*Inocotis papillosus*): Flocks of from twelve to twenty birds, feeding on the drier portions of the lake margin.

The Glossy Ibis (*Plegadis falcinellus*): Parties of twelve to fifteen birds appeared to be the usual thing. When flying away from or coming towards one in their usual V formation, they are easily mistaken for geese at a distance.

The Large White Egret (*Egretta alba*): Only two pairs were seen and one specimen secured. The birds were very shy and wary. Measurements of this specimen were as follows: Bill from forehead feathers, 127 mm., tarsus 214 mm., bill yellow; legs and feet greenish-black.

The Bar-headed Goose (*Anser indicus*): It was significant that during the three or four days spent at Shah Hassan not a single bird of this species was seen. When camp was shifted to Jhangār, about eight miles eastward, it was found that all the geese frequenting this portion of the *dhand* were *indicus* and no Grey Lags were observed. The two species appeared to have apportioned off distinct zones. The numbers of these birds were considerably less than those of the Grey Lag at Shah Hassan. Some large flocks were seen feeding on the young wheat and gram by the *dhand* in the early mornings and at sundown. They feed throughout the night and repair to the open water during the day where they ride on the surface and rest.

Among the ducks, the commonest species by far appeared to be the White-eyed Pochard (*Nyroca rufa rufa*). This bird is an expert diver, and unless squarely hit it dives and holds on to the submerged water weeds and is then extremely difficult to recover.

The Little Grebe (*Podiceps albipennis*): This little bird is also extremely abundant in the shallows. Flocks of fifty to sixty birds were common, and the rapidity with which they dived was indeed remarkable. When fired at, in many cases they had almost disappeared below the surface before the charge reached them! My diary records the following peculiarity as regards the colouration of the irides in fresh specimens which in the Fauna (*Birds*, 1st edn. vol. i, p. 475) is stated to be 'red-brown'.

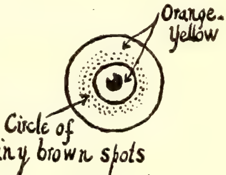


Fig. 3

Some of the other birds seen on the lake and in its precincts were:

The Spoonbill (*Platalea leucorodia major*); Large flocks on mud banks.

The Common Heron (*Ardea cinerea cinerea*): Quite common. Seen singly.

The Desert Buzzard (*Buteo buteo rufiventer*): Seen usually in pairs perched on mounds near the lake. Obtained a specimen.

The Pale Harrier (*Circus macrourus*): Extremely common. Continuously beating over the shallows everywhere.

Before concluding, a few hints as to how a shoot on the Manchar can be arranged may prove useful to intending sportsmen.

It is best to get into communication with the Deputy Collector of Sehwan (Larkana District) and inform him well in advance of the dates on which you propose to shoot. The stations to get down at are either Sehwan or Bubak Road on the N.W. Rly. (Karachi-Lahore) at both of which places tongas can be easily got. If you leave Karachi at 11 p.m. you reach Sehwan at 9 a.m. the next day, and Bubak Road is only 20 minutes further on. About Rs. 5 per day for a punt and crew would be enough.

There are no bungalows on the Manchar. The P. W. D. Bungalow at Bubak might be used. The Local Board Bungalow at Shah Hassan where we stopped is a long way from the Railway.

THE LANGURS, OR LEAF MONKEYS, OF BRITISH INDIA

BY

R. I. Pocock, F.R.S.

(*With 1 coloured and 1 black and white plate and 21 text figures*)

The Differences between the Langurs and the Macaques

Although the name Langur is, strictly speaking, the Hindi title for certain Monkeys restricted to the northern parts of India, it has been extended during recent years to include a great variety of related forms widely distributed in the East. In this paper I have adopted it for all the eastern monkeys which are not Macaques.

The Langurs are found mostly in thickly forested districts, throughout British India from Kashmir and Upper Burma in the north to Ceylon and Tenasserim in the south. Outside that area they extend into southern China and Siam and through the Malay Peninsula to Borneo. There are several genera; but the only one which, as occurring within the British area, concerns us at the present time, is the genus now called *Pithecus*, which was formerly better known as *Semnopithecus* or *Presbytis*.

Except where regarded as sacred and encouraged to enter native villages, Langurs avoid the presence of man and are essentially dwellers in the tree-tops, feeding mainly upon leaves, shoots and buds and, in case of alarm, passing from branch to branch with prodigious leaps or swinging from one branch to another by means of their arms somewhat after the manner of Gibbons. They are less terrestrial and more arboreal than the Macaques and differ from them also in diet. And the differences in these respects between these two groups of monkeys are accompanied by important structural modifications connected with the digestive organs and limbs. The Macaques have large cheek-pouches and a comparatively small, simple stomach, whereas in the Langurs there are no check-pouches and the stomach is capacious and sacculated. In the second place the hands and feet of the Macaques are shorter and broader than in the Langurs and have a larger thumb and great toe. (Text figs. 1A, 1B, 2A, 2B, 3A and 3B.)

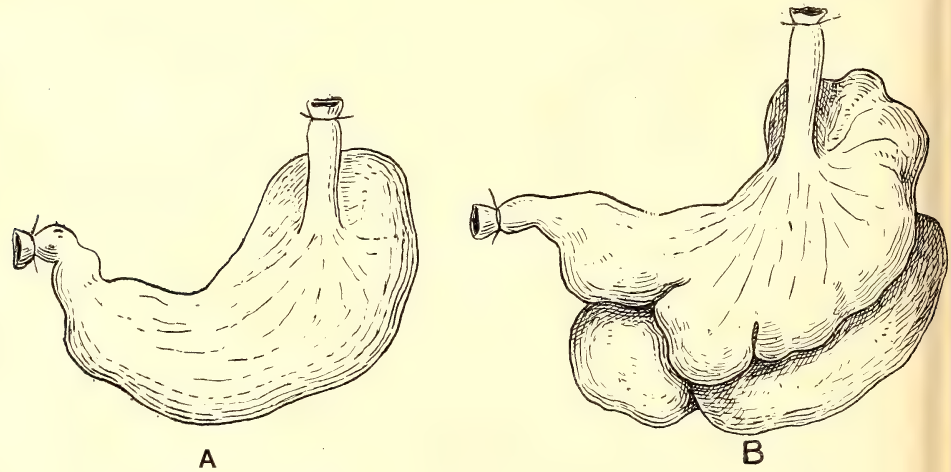


Fig. 1.—A. Simple stomach of the Common Macaque (*Macaca irus*) from the Malay Peninsula.

B. Sacculated stomach of Ceylonese Langur (*Pithecus senex vetulus*).

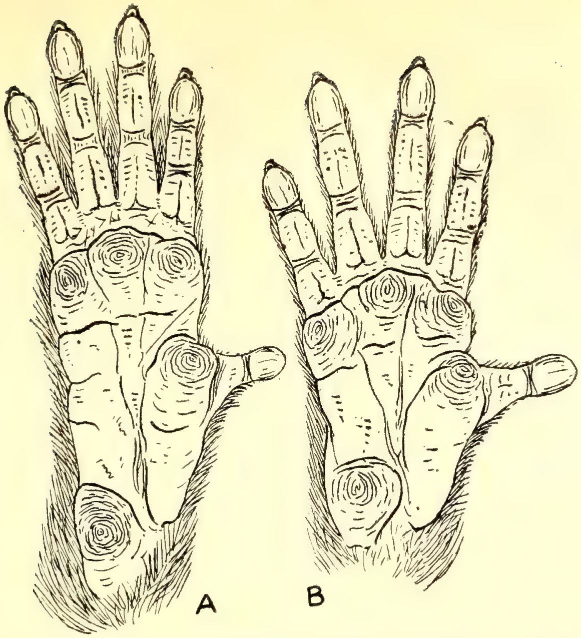


Fig. 2.—A. Hand of Indian Langur (*Pithecus entellus*). Half nat. size.
B. Hand of Malabar Macaque (*Macaca silenus*). Half nat. size.

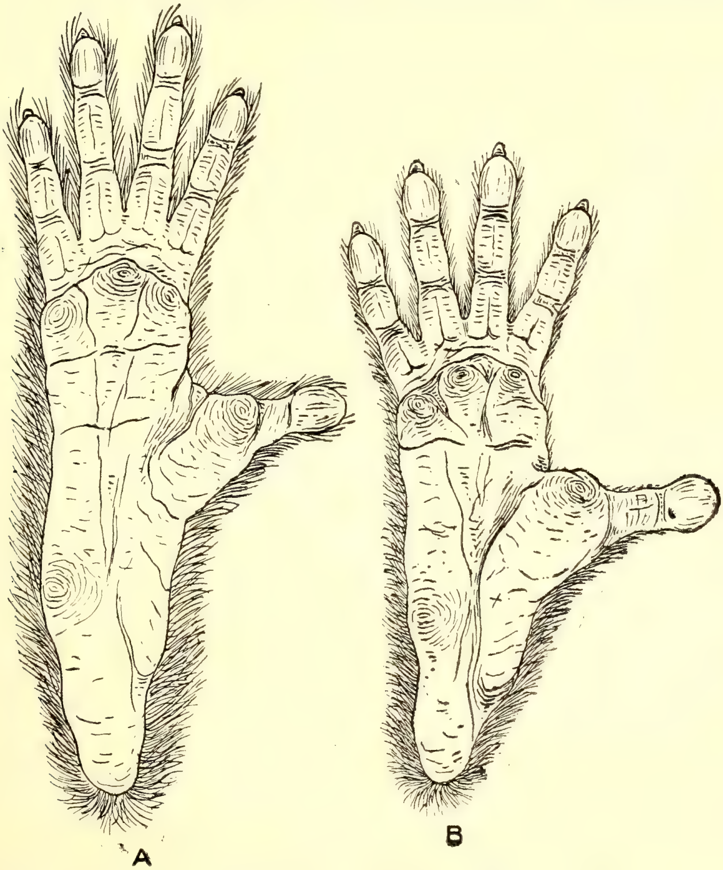


Fig. 3.—A. Foot of Indian Langur (*Pithecus entellus*). Half nat. size.
B. Foot of Malabar Macaque (*Macaca silenus*). Half nat. size.

These differences are expressed by referring the Macaques and Langurs to two distinct families, the Macaques to the *Cercopithecidæ*, which also includes the Baboons, Mangabeys, and some other African Monkeys, and the Langurs to the *Colobidæ*, which also includes the Guerezas (*Colobus*) of Central Africa.

THE CLASSIFICATION OF THE LANGURS

For the original descriptions of the Langurs of British India we are indebted to many authors, more particularly to Blyth; but the most important attempt to deal with them comprehensively was made by Anderson, who not only had in his hand Blyth's specimens in the Calcutta Museum, but also made a point of seeing, where possible, the specimens described by French, Dutch and other foreign zoologists and preserved in the Museums of various countries in Europe. This work which is a monographic revision of all the species of Langurs, then called *Semnopithecus*, known up to that time, was published in 1878 in the *Zoological Results of the two Expeditions to Western Yunnan*. It was an important treatise and formed the basis of Blanford's account of the Langurs contained in his classic volume of the *Mammals of British India*, published in 1891, and of Forbes's account of these monkeys in vol. ii of his *Handbook of the Primates*, 1894. But the arrangement and treatment of the species in the three volumes cited does not attest any clear understanding of their mutual affinities on the part of the authors; and this statement is still more true of Elliot's classification of the Langurs contained in vol. iii of his *Review of the Primates*, published as recently as 1913.

On working through the collection in the British Museum, I find evidence that the Langurs of the genus *Pithecus* may be divided primarily into three groups sharply distinguishable by the colour of the newly-born young; and this character is sometimes correlated with others in the skull, coloration or other external features of the adult which make it possible to assign with some degree of assurance to one or the other of the groups those species in which the coloration of the young has not as yet been ascertained.

These groups may be defined as follows :—

Group I.—Newly born young, a uniform dark blackish-brown all over. (Plate I, fig. 3).

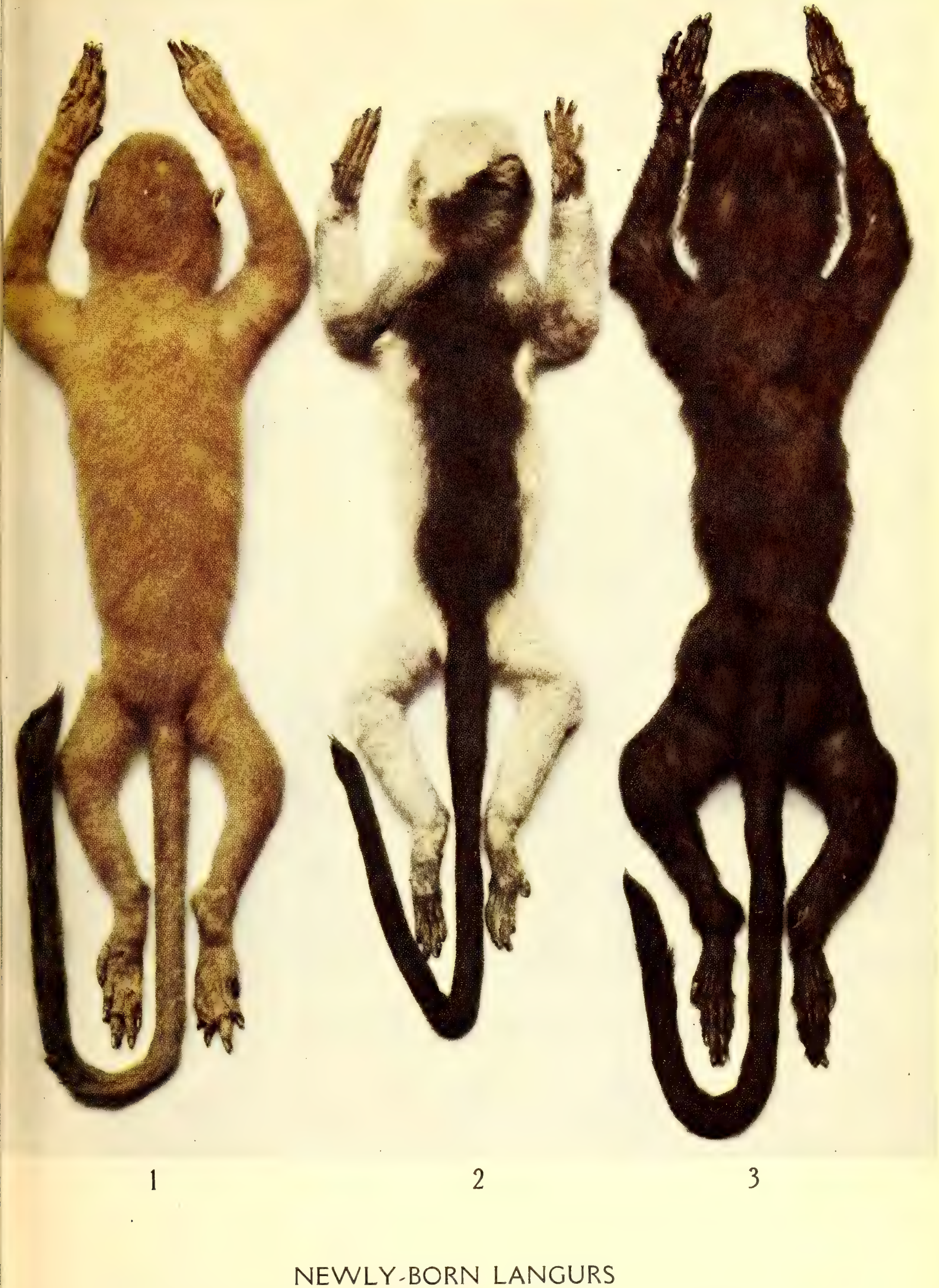
This group, which may be called the *Entellus*-group, since the Entellus Langur is the best known species contained in it, is restricted to India and Ceylon and ranges in suitable localities throughout those countries from the Himalayas southwards but does not, so far as is known, cross the Brahmaputra. All the known Langurs of this group are discussed in this paper. I refer them to two well-defined species, *Pithecus entellus* and *Pithecus senex*, each of which is represented by several local races or subspecies. The colour of the young has not been recorded, so far as I am aware, in the typical form of either of these; but it is known in the subspecies *dussumieri* and *achates*, which are admittedly closely related to typical *entellus*, and in the subspecies *johnii* which is admittedly closely related to typical *senex*.

Group II.—Newly born young, a uniform golden or orange red all over. (Plate I, fig. 1).

This group, which may be called the *Auratus*-group after one of its earliest known species, ranges from Assam, Upper Burma and Siam southwards through the Malay States, Sumatra, Java and Borneo. So far as British India is concerned it is represented by two distinct species, *Pithecus pileatus* found in Assam and other districts near at hand, and *Pithecus auratus* which, as here understood, extends from Upper Chindwin to Southern Tenasserim. Both these species are represented within the British Indian area by several local races.

Group III.—Newly born young parti-coloured, white below, on the sides of the body, the legs and the forepart of the head, but with a blackish or dark brown spinal stripe of varying width extending from the back of the head on to the tail and usually at all events spreading more or less on to the outer side of the arms. (Plate I, fig. 2).

This group I call the *Aygula*-group, from the oldest known species belonging to it. Containing several distinct species and subspecies in Borneo, Java, Sumatra and the Malay Peninsula, this group is more southern in its distribution than the *Auratus*-group and only just enters our area in South Tenasserim where it is represented by *Pithecus femoralis*, a species well known in the Malay Peninsula.



NEWLY-BORN LANGURS

1. The Auratus-Group. *2. The Aygula-Group.* *3. The Entellus-Group.*

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My conclusions regarding the numbers of different kinds of Langurs occurring in British India and concerning the importance of the differences between them vary considerably from those of my predecessors. It is needless here to enter into the details of this subject since they are set forth in the following pages ; but it must be explained that the divergence of opinion is due mainly to two things. In the first place, I use the word 'species' in a much wider and more comprehensive sense than that adopted by those who determined the langurs collected by the Mammal Survey, a great many of the forms they considered as species being regarded by me as subspecies or local races. In the second place, as compared with the pioneer workers, Blyth, Anderson and Blanford, I have had the advantage of most of the splendid material collected by the Mammal Survey, organized by the Bombay Natural History Society. Where the authors mentioned had only one or two, probably badly preserved skins and a few skulls to guide them, I have had several, in some cases a dozen or more properly prepared, measured and dated skins, from various localities, with skulls to match.

This material has revealed greater individual variation, especially perhaps in the skulls, than was formerly supposed to exist ; and it has established the occurrence of a number of local races or subspecies linking forms to which, in the absence, or rather ignorance, of intergrading types, full specific rank was by common consent formerly accorded.

Although the material collected by the Survey has vastly extended our knowledge of the Langurs of British India, it cannot be claimed that it has made easier the task of naming them. It has, indeed, greatly increased the difficulty of constructing analytical keys to facilitate their determination because it has shown the impossibility of assigning definite and constant characters to all the named representatives of this group. There is still much to be learnt about them. Further collections in areas not yet investigated, like the eastern parts of India from Orissa to south of Madras, will almost certainly bring to light new local races and will perhaps show that some of the forms here nominally distinguished are based upon characters not deserving that distinction. For the most part I have had several specimens to guide me ; but in others I have been compelled to rely upon a single locally isolated example ; and in cases where I have given a name to one or two such examples, it has been to draw especial attention to some particular character of interest, although of doubtful systematic value.

SYSTEMATIC ACCOUNT OF THE SPECIES AND SUBSPECIES

The characters of the three groups above described into which the Langur of British India fall may be expressed analytically as follows :—

(*a*) Newly born young uniformly coloured above and below ; never more than one frontal whorl in the hair on the head ; nasal bones in the skull not convexly bulging below the brow.
    (*b*) Newly born young uniformly blackish brown. (Himalayas to Ceylon) ... ... *Entellus*-group.
    (*b^1*) Newly born young uniformly golden yellow or golden red. (Assam to Tenasserim) ... *Auratus*-group
(*a^1*) Newly born young particoloured, white with a black or brown spinal stripe from the head to the tail tip ; a pair of frontal whorls ; nasal bones convexly bulging below the brow. (S. Tenasserim) *Aygula*-group.

I. The ENTELLUS-group.

Characters as set forth above.

The Langurs of this group were referred by Blanford and other authors to six or seven or even more species. But that method of treating them does not express their true affinities. They are very obviously assignable to two categories to which I give specific rank and their characters may be contrasted as follows:—

(*a*) A single whorl or parting on the forehead behind the brow ; hair of the loins not shorter than elsewhere on the back ; lower side of the body paler than the upper ; skull with prominent brows, the plane of the orbit sloping downwards and backwards from its upper to its lower rim ... ... *entellus*.

(a^1) No whorl on the forehead ; hair on the loins, or croup, shorter than on the back and typically paler ; lower side of the body approximately the same colour as the upper ; skull with less prominent brows, the plane of the orbit sloping downwards and forwards from its upper to its lower rim ... ... *senex.*

1. *Pithecus entellus*, Dufresne.

Simia entellus, Dufresne *Bull. Soc. Phil.*, Paris, i, p. 49, 1797.

It is needless to repeat the distinguishing characters of this species as stated above. It is also needless to quote more than the original reference to the name, because I use the specific title in a much more comprehensive sense than my predecessors to embrace the Langurs assigned by Blyth, Anderson, Blanford and other authors to several distinct species, *schistaceus*, *entellus*, *hypoleucos*, *anchises* and *priam*, all of which, with the possible exception of *anchises*, I regard merely as local races or subspecies of a single species for which *entellus* appears to be the oldest name available.

Distribution. North of the Ganges from Kashmir to Sikkim, possibly to Bhutan, and south of the Ganges from Cutch and Kathiawar to Bengal, thence southwards into northern Ceylon.

KEY TO THE SUBSPECIES OF *P. entellus*

(*a*) Whiskers long and thick, mostly or completely hiding the ears ; head and whiskers uniformly whitish or pale buff and contrasted with tint of back. (N. of Ganges).
  (*b*) Coat long, shaggy and mane-like ; arms below elbows black and strongly contrasted with colour of body ... ... *ajax.*
  (b^1) Coat shorter, not shaggy and mane-like ; arms and hands not black and not sharply contrasted with colour of body.
    (*c*) General colour dark earthy-brown ; coat thick and woolly ... ... *achilles.*
    (c^1) General colour paler, slaty or greyish-buff ; coat shorter and less woolly.
      (*d*) Skull larger, with prominent nasal region and larger teeth ... ... *hector.*
      (d^1) Skull smaller, with less prominent nasal region and smaller teeth ... *schistaceus.*
(a^1) Whiskers shorter, not or only partly hiding ears ; head and whiskers variable but never so white and strongly contrasted as in section (*a*) (S. of Ganges).
  (*e*) Hands and feet black and generally sharply contrasted with the arms and legs.
    (*f*) Crown of head at most only a little paler than nape and shoulders ; hands and feet black or brown and typically sharply contrasted with arms and legs ... ... *entellus.*
    (f^1) Crown of head clearly defined from the shoulders and back by its paler tint.
      (*g*) No tuft on crown ; upper portion of whiskers typically clouded with black.
        (*h*) Paler ; crown of head uniformly buffish in tint ; tail and outside and inside of legs below knees not black.
          (*i*) Arms below elbows not black, contrasted with the hands ... *achates.*
          (i^1) Arms below the elbows black, blending with tint of hands.

(*j*) Paler ; cheeks pale like the crown	*dussumieri.*
(*j*^{1}) Darker ; upper part of cheeks blackish ...	*iulus.*
(*h*^{1}) Darker ; crown of head suffused with dark hairs ; tail and outside and inside of leg below knee black.	
(*k*) Not so dark above or below ; inner side of thigh clothed with white hairs ; size smaller	*hypoleucos.*
(*k*^{1}) Darker above and below ; inner side of thigh mostly clothed with black hairs ; size larger	*æneas.*
(*g*^{1}) A tuft on the crown ; upper portion of whiskers pale like the crown ...	*elissa.*
(*e*^{1}) Hands and feet not black, practically uniform in colour with the arms and legs.	
(*l*) Crown of head pale, like the cheeks, and contrasted with back ; no tuft ; size smaller	*priamellus.*
(*l*^{1}) Crown of head typically darker than cheeks, hardly contrasted with back, and typically tufted ; size larger ...	*pallipes.*

In the construction of this key, my aim has been the juxtaposition of what appear to be related forms, although it would perhaps have been easier to make a frankly artificial analytical table by the rearrangement of the characters employed. But the actual or probable occurrence of intergrading specimens, it must be remembered, makes the construction of such keys difficult and their use somewhat unsatisfactory. Also it must be remembered that the distinctive features of *dussumieri* and *hypoleucos*, which I have not seen, have been inferred from the descriptions of authors and that the form, also unknown to me, named *anchises* by Blyth, which in the tint of its hands and feet is intermediate between *e* and *e*^{1}, has been omitted.

Subspecies *schistaceus* Hodgson.

Semnopithecus schistaceus, Hodgson, *Journ. As. Soc., Bengal*, ix, p. 1212, 1841.

Semnopithecus nipalensis, *id. ibid.*

Not *Semnopithecus schistaceus* of Blanford, Anderson and other authors, or at least only in part.

Dark slaty above; below and entire head pale yellow ; hands and feet somewhat darkened ; concolorous. Hair of one sort, more or less wavy. Head and body, 30 inches ; tail, 36 inches ; hind foot, 8½ inches.

Distribution. Nepal ; the Terai Forest.

The description of this race given above is taken from Hodgson's original diagnosis which, as indicated by the measurements, was based in all probability upon an adult male. It is important to remember this because the description cannot be applied to the adult males of any of the Himalayan Langurs in the collection of the British Museum.

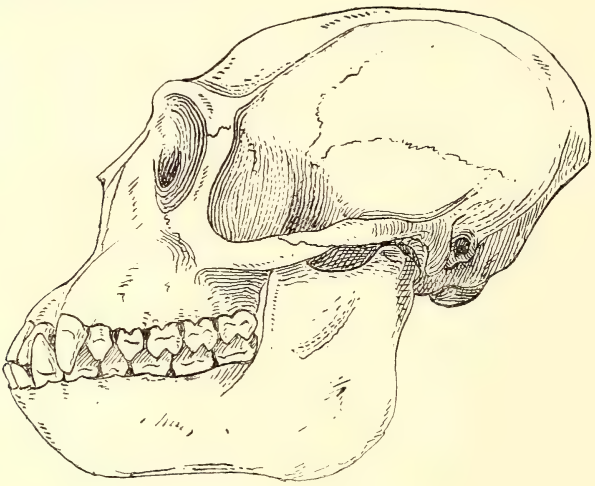
This series comprises several examples belonging to Hodgson's collection which are ticketed Nepal. No doubt Hodgson regarded them as specifically identical with the form he described as *schistaceus* ; but by no stretch of the imagination can they be described as 'dark slaty above.' They are most emphatically brown, without any perceptible trace of dark, or even light, grey to justify the epithet 'slaty.' Moreover, the available evidence suggests that these brown langurs, as stated below, live at high altitudes in Nepal and possibly Sikkim. There is at all events no evidence that I can find of their occurrence at the relatively low level of the Terai Forest ; and this was the opinion of Blanford, who supposed the langurs of the Terai to be typical *entellus* and thus rejected Hodgson's original locality for *schistaceus*.

The only specimen in the British Museum that was shot at a low level in Nepal is a female procured for the Mammal Survey by N. A. Baptista at Hazaria

Pathergatti at an altitude of 300 feet. This has the clearly defined pale head, the yellowish tinted under side and the uniform coloration of the upper side of the body and outside of the limbs described by Hodgson for *schistaceus* and Hinton and Fry[1] identified it as that form, probably quite correctly. It cannot, it is true, be accurately described as 'dark slaty above,' because the tint of the upper side is pale and greyish-buff. The animal, however, is a female giving the following approximate measurements in inches :—Head and Body, 23 ; Tail, 36 ; Hind foot, 7½ ; Ear, 1½ ; and since the skull, although the teeth are fully up and even worn, has the occipital suture open, the langur was probably not quite full-sized and might well represent the female of *schistaceus* on the assumption that Hodgson's type of *schistaceus* was a male.

This skull is of particular interest because it is intermediate between the skulls of typical *entellus* of the low levels of Bengal and those of the large langurs described below which inhabit the Himalayas at higher altitudes and have always, but wrongly, been regarded as true *schistaceus*. Its measurements in millimetres are as follows :—Total length, 115 ; length of palate, 41 ; of upper molars, 34 ; width across orbits, 64 ; across zygomata, 82. (Text fig. 4 B.)

It will thus be seen that it is noticeably smaller than the skulls of females of the races from Chamba, Kumaon and Sikkim and has smaller teeth. On the other hand, it hardly differs in these respects from the skulls of some examples of *entellus*, although the face is more sloped and less vertical than in average examples of that race owing to slightly greater prominence of the jaws, but the suborbital area of the face does not recede more than it does in many examples of *entellus*. The brow ridges are prominent and in the middle line rise vertically above the base of the nasals.



B

FIG. 4B.—Skull of *Pithecus entellus schistaceus* from Hazaria Pathergatti in the Nepal Terai, ♀ subadult. Two-thirds nat. size.

Subspecies *achilles*, nov.

(Plate II, fig. 2.)

Semnopithecus schistaceus, Anderson, Blanford, Elliot and other authors, at least in part.

Not *S. schistaceus*, Hodgson, 1841 (cf. *supra*).

Distinguishable from *schistaceus* by the nearly uniform chocolate or dusky sepia brown colour of the upper side of the body, the tail and the outside of the limbs. The upper surface, however, has a paler brown or buff sheen in

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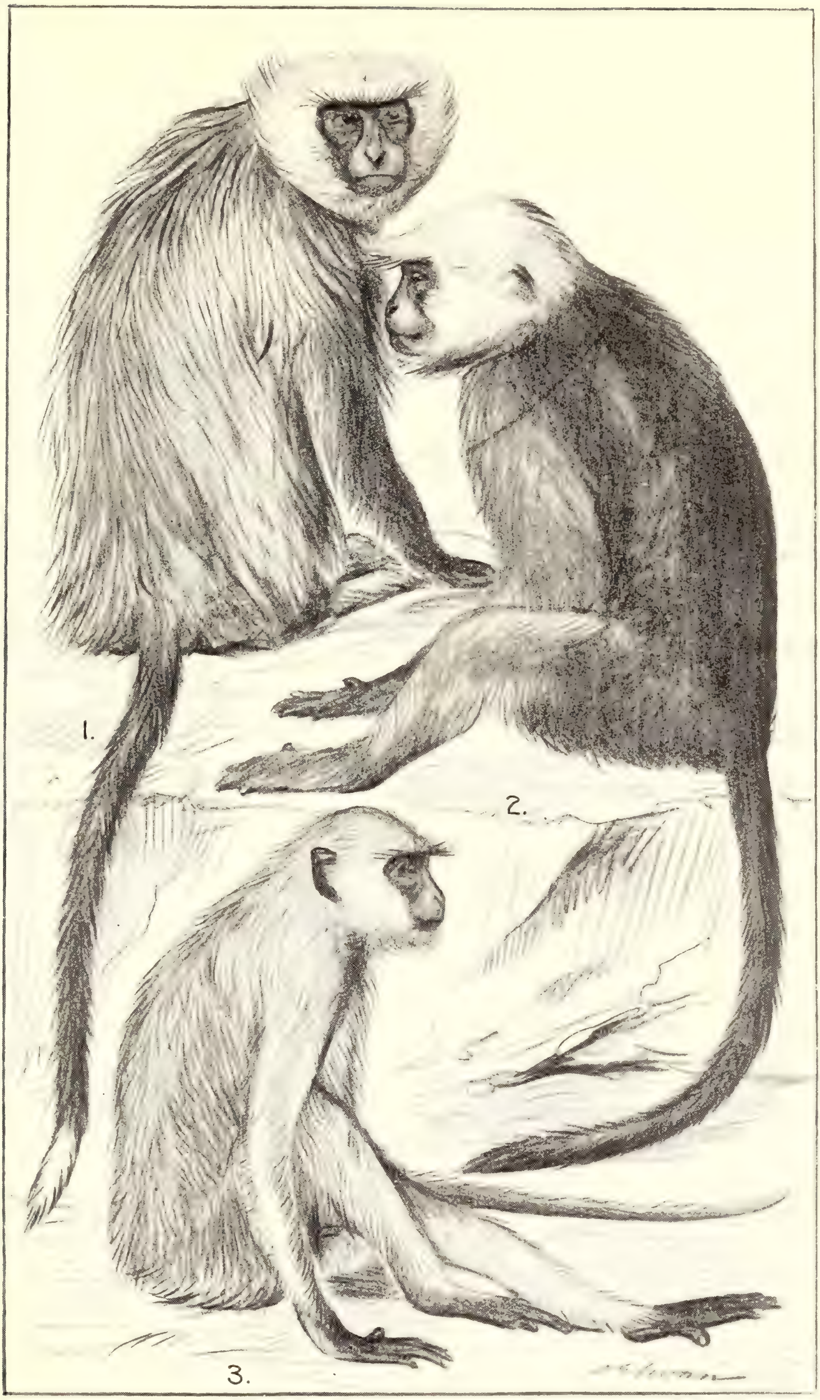
[1] *Jour.*, *Bomb. Nat. Hist. Soc.*, vol, xxix, No. 2, p. 404, 1923,



1. THE KANGRA LANGUR (*P. entellus ajax*)
2. THE NEPAL LANGUR (*P. entellus achilles*)
3. THE COMMON LANGUR (*P. entellus entellus*)

reflected light, the tip of the tail is sometimes pale and the hands and feet are sometimes patched with black. Head and nape of neck and whiskers cream or dirty white and contrasted with the brown hue of the shoulders. The lower side and the inner surfaces of the limbs whitish, sometimes tinged with buff.

Coat full, thick and long, but not markedly shaggy, the hairs being tolerably uniform in length and generally more or less wavy especially on the head.

Type. Adult male from the Satthar Hill (12,000 feet) in Gorkha, Nepal.

Distribution. Nepal at high altitudes ; and possibly Sikkim.

The only specimen certainly assignable to this race in the British Museum which is labelled with full particulars is the type mentioned above, an adult male shot for the Mammal Survey by N. A. Baptista at an altitude of 12,000 feet on Satthar Hill, Gorkha, about 50 miles north-west of Khatmandu. Its approximate measurements in inches are as follows :—

Head and Body	Tail	Hind Foot	Ear
30	36½	8⅘	1¾

These dimensions correspond tolerably closely with those recorded by Hodgson for *schistaceus* and with those of the males of the local race from Chamba and Kangra described below.

The skull, too, although somewhat flatter along the top, is very like the skulls of that subspecies, as the following dimensions in millimetres show :—

Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
147	57	38	84	108

In addition to the type, the British Museum possesses several skins of this race belonging to Hodgson's collection and ticketed Nepal. These, referred to above under *schistaceus*, have always been regarded as *schistaceus*. No doubt they were considered to be identical with it by Hodgson himself and also by Blanford who saw them. No doubt, too, they are the specimens, or some of the specimens, which induced Blanford to describe *schistaceus* as 'earthy or greyish-brown.' Earthy-brown describes them well ; but there is no grey in the pelage of the upper side of the body. Blanford, however, like Anderson, used the title *schistaceus* in a comprehensive sense for all the big langurs living at high altitudes in the Himalayas.

This race may also occur in Sikkim. There is at all events in the British Museum a skin, alleged to have been collected in Sikkim by Mandelli, which is in all important respects like the type and like Hodgson's specimens. Moreover, Elliot's description of *schistaceus* which he said was 'mars brown' above, was taken from a specimen in the Calcutta Museum ticketed Sikkim. And since many of Hodgson's specimens ticketed Nepal came, as Hinton has shown, from Sikkim, Hodgson's examples of *achilles* referred to above, may have come from the latter country.

The available skull material of *achilles* is unfortunately scanty. Setting aside the skull of the type, perhaps the most important is that of a young female belonging to one of Hodgson's specimens. A comparison between this skull and that of the female described above as *schistaceus* is interesting. It is much younger as is shown not only by the distinctness of its sutures but more particularly by the state of its dentition, the upper canine and last upper molar only just appearing above the bone of the jaw, both being probably covered by the gum when the monkey was alive. Nevertheless its measurements in millimetres are as follows :—Total length, 112 ; length of palate, 40 ; of upper molar series, 37 ; width across orbits, 69 ; across zygomata, 85. Thus it is wider across the eyes and temples, has larger teeth and as long a palate, and although a trifle shorter owing to the lesser development of the occiput, it would certainly have exceeded the length of the skull of *schistaceus* with growth. The profile too is very different and recalls that of the skull of the female of the race from Kumaon, described below, in the prominence of the nose and the receding brow.

Of Langurs from Kashmir there is very little material in the British Museum, namely two skins only. These, however, appear to be identical with the Nepal form *achilles*. This is perhaps surprising considering the difference between *achilles* and the Langur of Chamba and Kangra described below.

I provisionally refer to *achilles* four skins from Sikkim which are a little paler and greyer than skins from Nepal, but like them in the length and texture of the winter coat. The dimensions of three out of these four female specimens, collected in December and January for the Mammal Survey by Mr. C. A. Crump, are as follows :—

Locality	Head & Body	Tail	Hind foot	Ear	Weight
Chautang, 5,350 ft. ♀	26½″—	33″—	8″—	1¾″	...
Lachen, 8,800 ft. ♀	25″	28″—	7½″	1¾″	35 lbs.
Chautang, 5,356 ft. ♀	24″ –	30¼″	8″	1¾″	...

The only available adult skull is defective, one side of it having been shot away. It is a little lower in its facial portion than the female skulls of *hector* and *ajax*, but this may be an individual peculiarity because otherwise it is very similar, except that the nasal region is less prominent that in *hector* and like that of the Kangra examples of *ajax*. Its total length is 125 mm., and the upper molar and premolar teeth measure 38 mm.

This is probably the Langur which has previously been recorded from Sikkim as *schistaceus*. But, as stated above, there is in the British Museum a skin labelled Sikkim which was collected by Mandelli and presented by Blanford. But this skin is racially indistinguishable from Nepalese skins of *achilles* ; and since, according to Blanford, Mandelli's localities are not trustworthy, it is not improbable that the skin in question came from Nepal and not from Sikkim. And the same may be said of the example of *achilles* in the Calcutta Museum from Sikkim which Elliot described as *schistaceus*.

A distinguishable Himalayan race closely allied to *P. entellus achilles* has been described and may here be mentioned, although it does not, so far as is known at present, occur within the area of British India.

This is :—

Subspecies *lanius*, Elliot.

Presbytis lania, Elliot, *Ann. Mag. Nat. Hist.* (8), iv, p. 273, 1909 ; *id. Rev. Primates*, iii, p. 93, 1913 (under *Pygathrix*).

Colour very like that of typical *achilles* from Nepal but with a slightly greyer sheen especially on the loins and hind legs, and with more white on the back of the thighs. The coat is a little longer, thicker, softer and more wavy.

Distribution. Chumbi in Tibet, 10,000 feet.

The dimensions in inches of the single female specimen collected by Major F. M. Bailey are as follows :—

Head and body 25 ; hind foot 7½ ; ear 1¾.

The skull, which I have not seen, measures, according to Elliot, 125 mm. in total length, and the zygomatic breadth is 102 mm.

Subspecies *ajax*, nov.

(Plate II, fig. 1.)

Pithecus entellus, Lindsay, *Journ. Bomb. Nat. Hist. Soc.*, xxxi, p. 599, 1926 (not *P. entellus*, Dufresne.)

A big handsome langur as large as *achilles* but differing in the colour and texture of its coat. The general colour of the upper side is dusky brownish-grey, much greyer than in *achilles*, with the whitish cap on the crown typically less distinctly defined owing to a greyish tinge on the nape blending more or less with that of shoulders ; the arms below the elbows and the hands are black or blackish brown in adults and the legs paler greyish-brown, darkened with sooty grey on the thigh and knee in front, the feet at most a little darker than the area below the knee, with the foot bordered externally with white and some whitish hairs on the toes. The whiskers and throat, the under side of the body, the inside of the limbs and the backs of the thighs, and as much as four inches of the tip of the tail are white.

The coat is loose and shaggy, forming a kind of mane over the shoulders and upper part of the arms and on the flanks, and consisting largely of long greyish white glistening hairs such as are seen in typical *entellus*.

Type. Adult male from Deolah, Chamba, 6,000 feet (H. W. Wells).

Distribution. Northern Punjab ; Chamba, from 6,000 to 7,500 feet ; Kangra, from 2,450 to 9,500 feet ; Kulu, from 9,800 to 11,000 feet.

Young specimens differ considerably from adults in being much paler in colour both on the back and on the arms, and the coat consists of long thick more woolly hair, the coarser glistening hairs of the coat of the adult being practically absent. The examples from Chamba were collected in December and January by H. W. Wells. Those from Kangra, procured in March and April, differ in having the pale cap on the head more clearly defined and in having the arms browner. Three females from Kulu, collected in June, still carry the winter coat but it is very shaggy and wavy. These specimens also have paler arms. Such differences as those observed between the Chamba, Kangra and Kulu individuals are probably seasonal.

The following are the approximate measurements in inches of some selected individuals :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
Chamba, Deolah, 6 000 ft., ♂ ...	30″	38″	9″	2″	..
,, , Bara Tissa, 7,500 ft., ♂ ...	30″	32″	8″	2″	43 lbs.
,, , Chalan Tissa, 6,700 ft., ♂..	30″	33″—	9″	2″	...
Kangra Fort, 2,450 ft. ♂	31″	34½″	8½″	1½″	46 lbs.
,, , Chicaian, 9,000 ft., ♀ ...	27″	28½″	8½″	1½″	28 lbs.
,, , Samyala, 9,500 ft., ♀ ...	23″—	34″	7″	1½″	...
Kangra, 2,400 ft., ♀	24″	33″	7½	1½″	...
Kulu, Rahla 9,800 ft. ♀	21″—	31″	7	1½″	...
,, ,, ,, ,, ♀	20″	30½″	7	1¾	...

The skulls (Text fig. 5A.) do not differ in any important points from those of *achilles*, as represented by the one from Gorkha and the fragments of those collected by Hodgson referred to above. The following table shows their dimensions in millimetres :—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
Chamba, ♂ ...	147	57	41	84	111
,, , ♂ ...	145	54	40	82	111
,, , ♂ ...	141	54	40	84	109
Kangra, ♂ ...	144	54	41	84	109
,, , ♀ ...	124	46	40	72	94
,, , ♀ ...	120	43	40	73	94

Subspecies *hector*, nov.

Presbytis schistaceus, Wroughton, *Journ., Bom. Nat. Hist. Soc.*, xxiii, p. 286, 1914 (not *P. schistaceus*, Hodgson).

Approximately the same size as *achilles* and *ajax* but differing from both in colour and in the shortness of the hairs of the winter coat. General colour slaty-grey tinged with buff or pale brown ; the outside of the arms grey below the elbow and a little darker than the back, but not nearly so dark as in *ajax* ; the outside of the legs paler than the back and with a sooty grey tint on the thigh in front. The white cap on the head and nape sharply defined and the under side either dirty white or more frequently suffused with buff or pale red. The winter coat consisting of hairs of tolerably uniform length, shorter than in *achilles* and not so thick and very much shorter than in *ajax*.

Type. Male (skin and skull) from Sitabani, Ramnagar, Kumaon, 2,000 feet. B. M. No. 14.7.10.10.

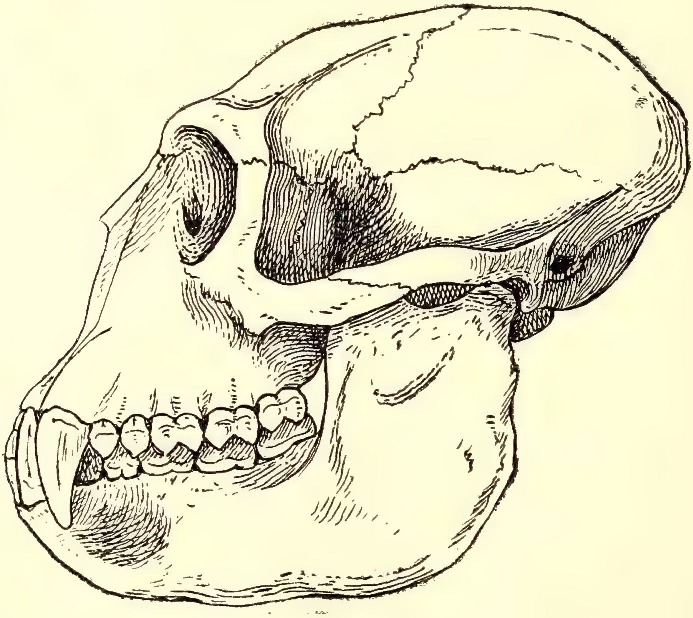
Distribution. Kumaon up to 6,000 feet.

In general coloration the known examples of this race closely resemble the specimen of *schistaceus* from Hazara Patherghatta described above. The skulls of adult females of the two are, however, different in dimensions and shape, those of *hector* being larger, with bigger teeth, less pronounced brows and more prominent nose. But additional specimens from the Terai Forest may prove *hector* to be identical with *schistaceus*, if the skulls are found to intergrade.

The following table gives the approximate dimensions in inches of the skins of this langur shot by C. A. Crump in November, January and February :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
Champawat, Almora, 6,000 ft., ♂ ...	27½+	39	9+	2 —	...
Sitabani, Ramnagar 2,000 ft., ♂ ...	26	37	8½+	2 —	38 lbs.
Dela, Ramnagar, 1,500 ft., ♀ ...	24+	33½—	7½+	1½	39 lbs.
Ratighat, Naini Tal, 3,700 ft., ♀ ...	23½+	33	8	2 —	31 lbs.

The two males, it will be seen, are a little smaller than the adults from Chamba ; but the skulls show them to be rather younger animals.



A

FIG. 5A.—Skull of *Pithecus entellus ajax* from Chamba, ♂ ad. Two-thirds nat. size.

The skulls generally resemble those of *achilles* and *ajax*, but have the nose more prominent. This is particularly noticeable in the skulls of two adult females when compared with the skulls of adult females of *ajax* from Kangra. It is also observable in two male skulls. These also are narrower than the skulls of adult males of *ajax* ; but they are younger, the basioccipital suture being still open. Their youth, no doubt, accounts for their narrowness ; and probably increase in the size of the brow ridges with advance of years would lessen the appearance of prominence of the nose. (Text fig. 4A.)

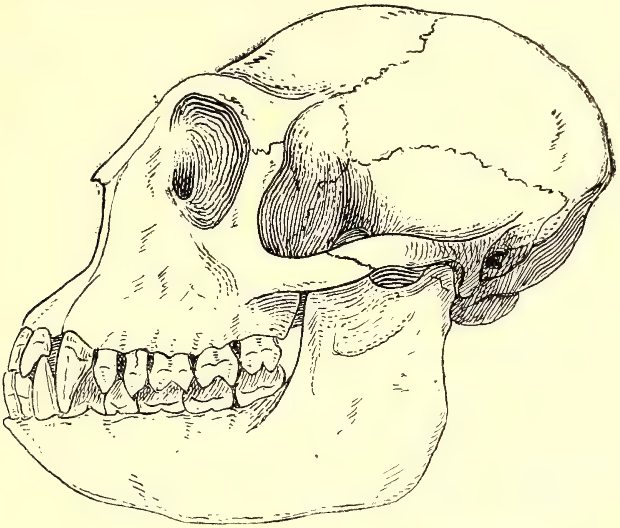


FIG. 4A.—Skull of *Pithecus entellus hector* from Naini Tal. ♀ ad. Two-thirds nat. size.

The dimensions in millimetres of four skulls are as follows :—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
Ramnagar ♂ ...	135	50	3	77	96
,, ♂ ...	132	49	40	75	98
Naini Tal ♀ ...	123	46	40	70	94
Ramnagar ♀ ...	119	46	41	70	90

Several skulls of adult males from Garhwal, presented to the British Museum by B. B. Osmaston, may, for geographical reasons, be provisionally assigned to this race ; but unfortunately there are no skins from this district of Kumaon by which the correctness of this inference can be tested. These skulls do not differ appreciably from those of *achilles* and *ajax*.

The Langurs recorded by Blyth on Hutton's authority as occurring in Mussoorie and Simla up to 11,000 feet and described by Hutton as dark greyish with pale hands and feet and white head, throat breast and tail-tip, certainly differ from *ajax* from Chamba, but appear to agree very closely with this Kumaon race, *hector* ; and a number of skulls of adult males presented by Hutton to the British Museum, which may have been procured by him either at Simla or Mussoorie, are not distinguishable from the skulls of adult males of *ajax* and *achilles*. Nevertheless, as stated above, the skulls of adult females of *hector* from Kumaon have, owing to the prominence of the nose, a different appearance from adult female skulls of *ajax*.

Subspecies *entellus*, Dufresne.

(Plate II, fig. 3.)

Simia entellus, Dufresne, *Bull. Soc. Phil.*, Paris, 1, p. 49, 1797.
Semnopithecus or *Presbytis entellus* of Blyth, Anderson, Blanford, etc.; and of Dollman, *Journ.*, *Bom. Nat. Hist. Soc.*, xxii, No. 3, p. 438, 1913.

Smaller than the Himalayan races and distinguishable from them by the uniform coloration of the head and shoulders and by the sharp contrast between the black or brown and black hands and feet and the grey of the arms and legs below the elbows and knee. General colour of upper side darker or lighter shining sepia brown, becoming paler on the shoulders and head. Outer side of arms to, or almost to, the wrists and of the legs down to, and often including, part of the foot, much the same tint as the back, as also is the greater part of the tail ; but the leg below the knee is generally paler and greyer and the end of the tail is usually nearly white. The whiskers, which do not conceal the ears, the throat, the chest, the belly, the inside of the limbs and the back of the thighs whitish or buffy-white.

Distribution. Northern parts of peninsular India south of the Ganges from Bengal westwards to Kathiawar and Guzerat.

The Mammal Survey secured a useful series of this langur from various localities ranging from Bengal, whence the original example came, westwards to Kathiawar and Guzerat. I have been unable definitely to establish the existence of local races over the whole of this area which is probably tolerably uniform in its physical features ; but the series of skins as a whole shows that *entellus* is not nearly so sharply differentiated as is suggested by the writings of Blanford and other authors. Blanford, for instance, following Blyth and Anderson, lays great stress upon the uniform tint of the head and shoulders, involving the absence of a distinct pale cap on the crown, and the sharp contrast between the blackness of the hands and feet and the paler tint of the arms and legs. Both these features are, however, variable. In a series from Midnapore (200 feet), for example, the head is paler than the shoulders, but the tints blend on the nape ; the hands and the feet are black in adult males but brown with black fingers and toes in a young male and adult females. Similar variation with age in the tints of the extremities is seen in other specimens. A female from Junagadh in Kathiawar is darker above than the Midnapore examples but has the feet grey with black toes and the hands and wrists black ; and a female from Deesa in Palanpur is paler than the Midnapore series but this langur was shot in May when it was apparently still carrying its shaggy winter coat.

The following are the approximate dimensions in inches and the weights of a few specimens picked haphazard :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
Hazaribagh, 1,000 ft., ♂	25½	42½	8¼	2	...
Midnapore, 200 ft., ♂ ...	25	44	8½	1¾	35 lbs.
Hoshangabad, 3,300 ft., ♂ ...	25	42½	8½	2	...
Chikalda, Berar, 366 ft., ♂ ...	23½	42	8½	...	...
Junagadh, Kathiawar, 200 ft., ♂ ...	23	37½	7½	1¾	...
Seonbadoh, Berar, 1,800 ft., ♀ ...	23	37½	7¾	1¾	...
Midnapore, 200 ft., ♀	22½	38	7	1½	25 lbs.
Deesa, Palanpur, ♀	21½	35	7¼	1¾	...

These measurements bear out the statement made above regarding the comparative dimensions of *entellus* and the related langurs to the north of the Ganges. In connection with Blanford's statement that the ears of *entellus* are larger than those of *schistaceus*, it must be remembered that he was unacquainted with *schistaceus* in the restricted sense in which that term is used in this paper. The ears on dried skins of *entellus* look larger mainly because they are not concealed to the same extent by the whiskers. Nevertheless they are on the average a little larger than the ears of the races from the high Himalayas.

The skulls vary greatly in shape. Blanford's statement that the skull differs from that of the mountain forms he took for *schistaceus* in having the nose not projecting beyond a straight line tangential to the middle of the brows and the alveolar border of the incisor teeth is not true. In two female skulls from Hewra in Nimar and Seone, Malwa in the Central Provinces, the nose projects beyond that line. Similar variation in the shape of the cranial portion may be seen by a comparison between the figure of an adult male skull of *entellus* published by Blanford where the upper surface is low and flat, with a very long and projecting occipital region, and the skull of the adult male from Hazaribagh which is more steeply sloped. Of particular which is interest is the skull of an adult male from Deesa in Palanpur, which in its low facial portion recalls the skull of the South Indian and Ceylonese race formerly known as *priam* and described below as *pallipes*. Nevertheless, as Anderson pointed out, the skulls of *entellus* certainly differ on the whole from those of the northern mountain races in having the line of the face more vertical, with the nose and jaws less prominent. It also is a little smaller and has smaller teeth. But, as stated above, these differences will in all probability be found to break down when more is known of true *schistaceus* from the Nepal Terai. (Text figs. 5B, 6A, 6B, 7A and 9A.)

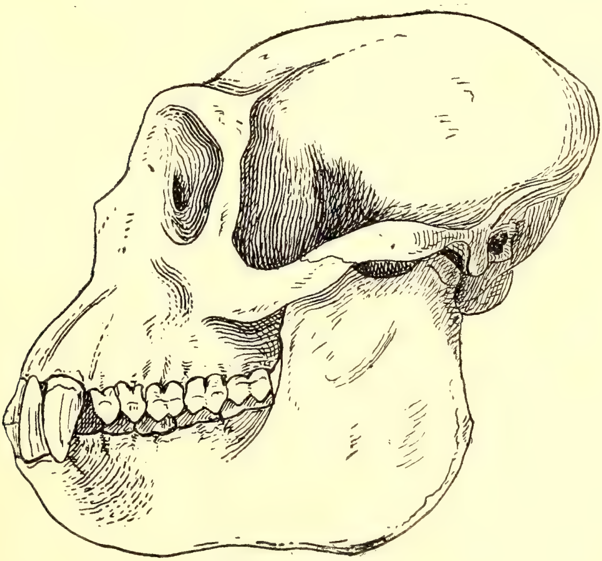


FIG. 5B.—Skull of *Pithecus entellus entellus* from Hazaribagh, ♂ ad. Two-thirds nat. size.

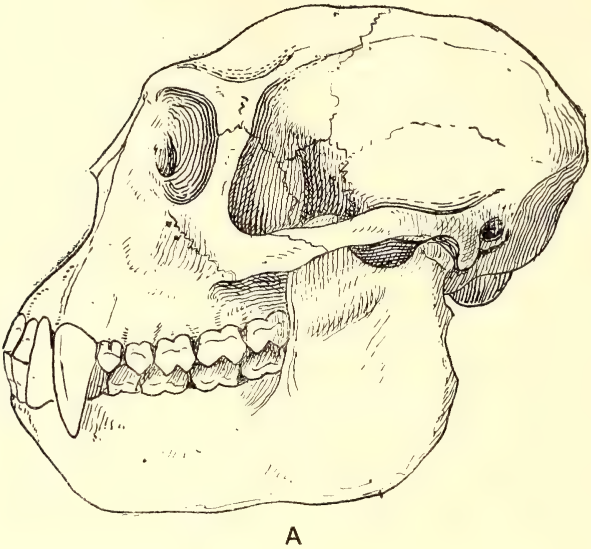


FIG. 6A.—Skull of *Pithecus entellus entellus* from Midnapore. ♀ subadul
Two-thirds nat. size.

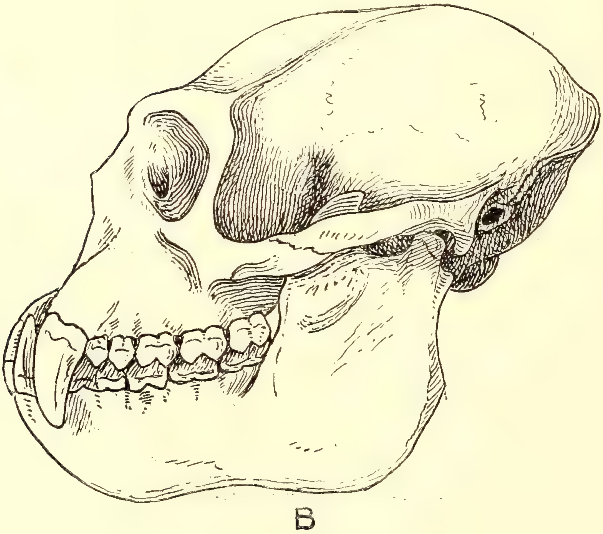


FIG. 6B.—Skull of *Pithecus entellus entellus* from Palanpur. ♂ ad.
Two-thirds nat. size.

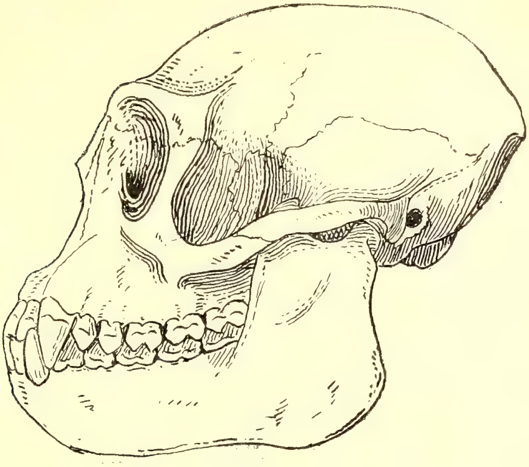


FIG. 7A.—Skull of *Pithecus entellus entellus* from Hoshangabad. ♀ ad, Two-thirds nat. size.

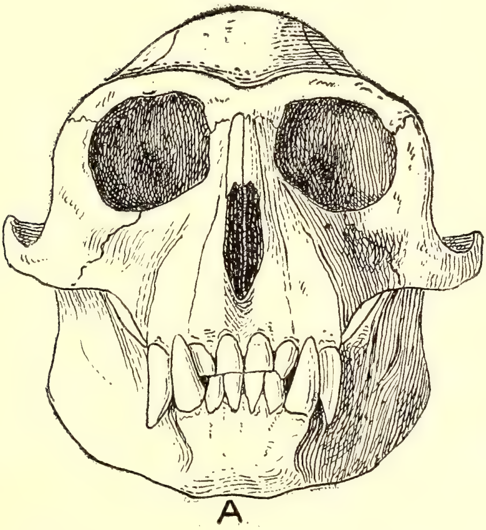


FIG 9A.—Skull of *Pithecus entellus entellus* from Midnapore, ♂ subadult. Two-thirds nat. size.

The following are the measurements in millimetres of some of the specimens :—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
Hazaribagh, ♂ ...	131	51	34	82	106
,, ♂	128	47	36	78	102
Bengal, ♂ ...	128	46	37	81	104
Deesa, ♂ ...	127	42	36	81	103
Midnapore, ♂ ...	123	46	36	74	92
Chikalda, ♂ ...	120	42	33	75	98
Junagadh, Kathiawar, ♂ ...	120	42	35	73	91
Midnapore, ♀ ...	110	36	34	67	89
Hoshangabad, ♀ ...	109	37	35	65	87
Junagadh, ♀ ...	106	37	33	72	88

With the exception of the second and third on the list, which were presented to the British Museum by Mr. W. Theobald, these skulls were collected by the Mammal Survey. The male examples from Midnapore and Junagadh are not quite fully developed.

Blyth (*Journ., As. Soc., Bengal,* xiii, p. 470, 1844 and xvi, p. 733, 1847) gave the name *anchises* to the skin of a Langur, from an unknown locality in the Deccan, which he described as like the darkest examples of *entellus* but with the hands mixed white and blackish, the feet whitish with dusky black above the base of the toes and on the terminal phalanges and the leg from the knee whitish. Coat generally much longer, the hair from 4 to 6 inches on the sides of the body and not wavy as in *entellus* ; the toes having long hairs like those of a spaniel's paw.

Out of the very large number of *entellus* and *entellus*-like langurs in the British Museum procured by the Mammal Survey in India to the south of the Ganges, there is not one that exactly fits the description of *anchises*. Nearest to it comes a female, collected in November at Hewra (1,000 feet) in Nimar. This resembles *entellus* in the uniform tint of the head and shoulders ; but the coat, as in *anchises*, is long, there are longish hairs on the toes and the feet are much paler, being grey, like the leg, with some black hairs on the knuckles. The hands, however, are not so pale as in the type of *anchises* ; they are distinctly brown, that tint blending with the colour of the arm, and have black hair on the knuckles.

Very like this example from Nimar is one obtained by Mr. Prater at Lahi, Seone Malwa, in the Central Provinces ; but the hands and feet are a little darker ; and a second specimen from the same locality is still blacker on its extremities and is hardly different from *entellus* in that respect, but the head is paler than the shoulders as in the more southern races below recorded.

These specimens, with the type of *anchises*, are peculiarly interesting because they show a complete gradation in the colours of the hands and feet between *entellus* and the *entellus*-like form from Southern India and Ceylon usually cited as *priam* or *priamus* which is described below under the name *pallipes*. And the specimen with the darkest hands and feet and the paler head similarly reveals a gradation between *entellus* proper and the race next described.

The exact status of *anchises* must for the present be left unsettled. It may represent a distinct subspecies. At all events on the available evidence it cannot be assigned to typical *entellus* ; and equally certainly it cannot be regarded as identical, as Blyth supposed, with the black-footed, black-handed forms of southern India. Conceivably it may represent a variety or sport of either.

Subspecies *achates*, nov.

Semnopithecus anchises var. Blyth, *Journ. As. Soc., Bengal,* xiii, p 471, 1844.
Presbytis entellus anchises, Dollman, *Journ. Bom. Nat. Hist. Soc.*, xxii, No. 3, p. 442, 1913. Not typical *S. anchises*, (cf. *supra.*)
Semnopithecus hypoleucus, Blanford, at least in part. Not *S. hypoleucos*, Blyth.

Closely related to typical *entellus* and intergrading with it, but with the buff or greyish-buff coloured crown of the head paler than the shoulders and differentiated in tint, although not so sharply differentiated as in the races to the north of the Ganges. Its hair also is more woolly. The general tint of the dorsal surface is on the average somewhat darker, the upper part of the cheek between the eye and the ear is tinged with blackish-grey and the black of the hands and feet is not so defined from the tint of the arms and legs owing to the somewhat darker hue of the lower half of these limbs, especially of the legs below the knees.

Distribution. Bellary, Dharwar and Kanara, from 1,500 to 2,000 feet in the Western Ghats; also Karwar, on the sea coast, to the west of the Ghats.

Type. Adult ♂ from Hausbavi, 2,000 feet, S.W. of Dharwar. B. M. No. 14.11.18.1.

The following are the measurements and weights of some of the specimens collected by Mr. Shortridge for the Mammal Survey :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
Vijayanagar, Bellary, 1,600 ft., ♂ ...	26½″—	40″	8½″+	2″+	35 lbs.
Hausbavi, S. Dharwar, 2,000 ft. ♂...	27″—	43″+	8″	2″—	30 lbs.
Devikop, 26 miles S. of Dharwar, 2,000 ft., ♂ ...	26½″	39½″	7½″	2″—	...
,, ♂ ...	26″	38″	7½″	2″—	...
Samasgi, Kanara boundary, S. W. Dharwar, 2,000 ft., ♂ ...	24″	34″	7″	1½″	22¾ lbs.
,, ,, ♂ ...	24″	34″	7″	1½″	19½ lbs.
Vijayanagar, Bellary, 1,500 ft., ♀ ...	26″	35″	7½″—	2″	27 lbs.
Alnavar, Dharwar, ♀	26″	34½″	7½″+	2″—	...
Devikop, 26 miles S. of Dharwar 2,000 ft., ♀ ...	25″	37½″	7½″	2″—	...
Hausbavi, S. Dharwar, ♀ ...	24½″—	33″	7″	1¾″	22½ lbs.
Samasgi, Kanara boundary, S. W. Dharwar, 2,000 ft., ♀ ...	22½″—	31½″	6½″	1½″	17 lbs.

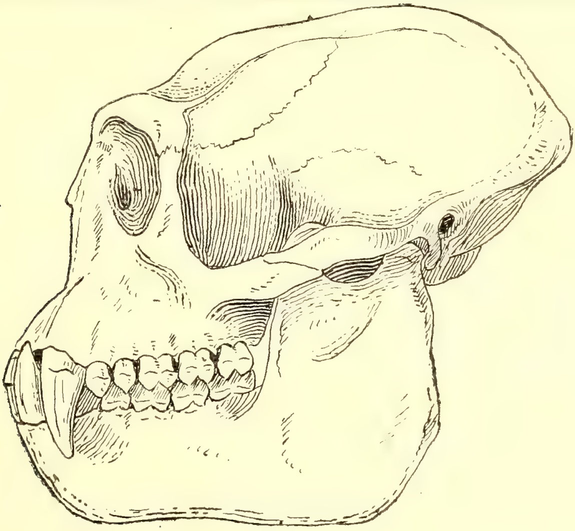


FIG. 7B.—Skull of *Pithecus entellus achates* from Hausbavi. ♂ ad. Two-thirds nat. size.

Three examples collected at Potoli, N. Kanara (1,800 feet) are interesting. Two of them resemble typical *achates* in colour; but the third is darker, as dark as the two examples from Jog described below, and is in this respect a transitional specimen between the two races.

From Blyth's original description of *anchises* it is clear that he knew by hearsay from Elliot of the existence of *entellus*-like langurs to the south of the range of typical *entellus*. Although he did not know the exact locality of his type of *anchises*, he stated that that form represented *entellus* in the Deccan and along the foot of the Western Ghats. He also had a specimen from Coimbatore which he regarded as a probable variety of *anchises* from which it differed by having black hands and feet as in *entellus*. This langur no doubt belonged to the race here described as *achates*. It was probably Blyth's statement regarding the distribution of *anchises*, and not his description of it, that induced Dollman to identify as *anchises* the langurs here described as a new subspecies.

The skulls (Text fig. 7B) in form and also in individual variability are very like those of typical *entellus*, but are smaller, with a more vertical face, shorter jaws and smaller teeth. The measurements in millimetres of a few of them are as follows:—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
Hausbavi, ♂ ...	118	41	32	74	93
Samasgi, ♂ ...	116	37	30	66	87
Potoli, N. Kanara, ♂	112	40	34	70	91
Devikop, ♂ ...	112	38	32	70	—
Vijayanagar, ♀ ...	110	38	33	69	89
Alnavar, ♀ ...	110	39	31	68	84
Samasgi, ♀ ...	102	32	30	65	81
Karwar, ♀ ...	100	34	31	61	82

These measurements show that whereas the skulls of the males are on the average distinctly smaller than those of *entellus*, the skulls of the females are quite as big. The sexual difference, therefore, in *achates* is much less than in *entellus*. Since moreover, the body measurements of the males attest approximake equality in size between the males of *achates* and *entellus*, it is evident that the males of *achates* have a relatively much smaller head.

Subspecies *iulus*, nov.

Resembling and intergrading with *P. entellus achates*, but smaller and with closer, softer, less shaggy hair, and darker in tint, the back being deep brown, against which the pale buff coloured head shows up conspicuously. Cheeks with a considerable quantity of black hair between the eye and the ear, as in *achates*. Arms in the male black from the elbow outside, a little paler in the female. Legs deep greyish-brown outside. Tail blackish-brown with the terminal third whitish. Lower surface and inside of arms and legs pale as in *achates*.

Distribution. Jog, Gersoppa Falls on the Kanara-Mysore Boundary, 1,300 feet. (G. C. Shortridge).

Type. ♂, B.M. No. 14.11.18.7.

The two adult examples collected at this locality give the following approximate measurements in inches:—

Sex	Hand and Body	Tail	Hind Foot	Ear	Weight
♂	20½″+	34″	6½″+	1¾″	21 lbs.
♀	20″+	36″	6¾″	1¾″	18½ ,,

Except for the conspicuous paleness of the head, this langur much resembles the race, *hypoleucos*, in the darkness of the back, the black tint of the arms and the proximal two-thirds of the tail ; but in the paleness of the head, of the tip of the tail, the grey hue of the outer side of the legs and the absence of the blackness from the inner sides of the arms and legs it is like typical *achates*. And the interest of the specimens lies in the link they form in the chain between *hypoleucos* and *entellus*. (Text fig. 8A) hitherto regarded as well-defined species.

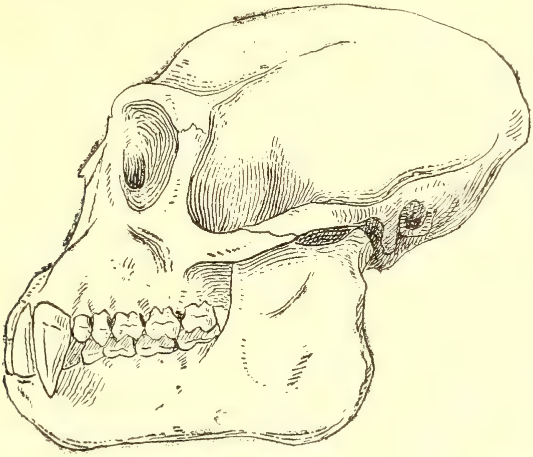


FIG. 8A.—Skull of *Pithecus entellus iulus* from Jog in Kanara. ♂ ad. Two-thirds nat. size.

The skulls measure, in millimetres, as follows :—

Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
♂	106	35	30	65	84
♀	103	36	31	63	85

Judging from the somewhat scanty material, there is scarcely any difference in size between the male and female of this race.

Subspecies *dussumieri*, Geoffr.

Semnopithecus dussumieri, I. Geoffroy, *C. R. Acad. Sci.*, xv, p. 719, 1842, and *Arch. Mus.*, ii, p. 538, pl. xxx, 1843.

Back greyish-brown ; crown of head, cheeks, neck and flanks yellowish ; outer surface of arm to the elbow a little darker than the back, from the elbow to the finger-tips black ; outer surface of legs to the ankle a little darker than the back, feet black ; tail black turning to greyish-brown in the terminal third ; under side and inside of limbs yellowish.

Distribution. Coast of Malabar.

Since the single known example of this langur was collected by a Frenchman, it probably came from Mahé, the French Colony in Malabar.

No langurs quite resembling this race, as described and figured, were collected by the Survey, those most like it being the specimens referred to *achates* and *iulus*. The latter, indeed, so far as it is possible to judge, only differs from *dussumieri* in being much darker on the back, which cannot be described as greyish-brown, and in having the upper part of the cheek or whiskers between the eye and ear washed with black pigment. Otherwise they appear to resemble one another in colour, particularly in the blackness of the arm below the elbow. Close resemblance to *dussumieri* is also shown by *achates*, but in the latter the arm below the elbow is not black, being noticeably paler than the hand, the upper part of the cheek is dark and the basal two-thirds of the tail is not black. It may be added that *dussumieri* differs from *hypoleucos* in being much paler above and in having the area of the leg below the knee about the same tint as the back and not black. Yet in spite of these obvious differences between the description of *dussumieri* and the type of *hypoleucos*, which he had in his hands and described, Anderson quoted *dussumieri* as an unquestionable synonym of *hypoleucos*. Naturally his description of *hypoleucos* does not fit *dussumieri*. Blanford, on the other hand, gave a description of *hypoleucos* which fits *dussumieri*, but not the type of *hypoleucos*. Finally, Elliot's statement that the type of *dussumieri*, which he saw in the Paris Museum, agrees with his description of an apparently accurately determined specimen of *hypoleucos* from Travancore must be untrue, if any reliance is to be placed on Geoffroy's description and figure of *dussumieri*.

Subspecies *hypoleucos*, Blyth.

Semnopithecus hypoleucos, Blyth., *Journ. As. Soc., Bengal*, x, p. 839, 1841; also xiii, p. 470, 1844; and xvi, p. 733, pl. xxvi, fig. 1, 1847 (*Presbytis*). Anderson, *Zool. Res. Yunnan*, p. 20, 1878. Not *S. hypoleucos*, Blanford, *Mamm. Brit. India*, p. 33, 1888, or at least only in part.

Back and shoulders deep dusky brown, head and whiskers brownish-white, a little darker on crown; outer surface of arms to elbows and of legs to knees the same colour as the back but arms below the elbows and legs below the knees, including the hands and feet, black; tail also black. Sides and lower surface of body, inner side of arms to elbows and of legs to knees white; arms below elbows and legs below knees mostly black with some whitish hairs on the arms and on the front of the leg.

Distribution. Travancore.

No langurs exactly fitting this description, which is taken from Blyth's original diagnosis, were collected by the Mammal Survey. Blyth had one skin of an old male said to have come from Travancore and the dimensions he gave of the head and body, 21 inches, and of the tail, 32 inches, are probably only approximately correct. Nevertheless, Anderson, who extracted the skull from Blyth's type, stated that its total length is 106 mm., and since this type was an old male, it is clear that *hypoleucos* is a small race closely resembing in that particular the race from Jog described as *iulus*. It is also evidently very like *iulus* in colour especially in the blackness of the outer side of the arm below the elbow; but it differs from *iulus* in having the legs below the knees black outside and inside, with apparently more black on the inside of the arm below the elbow and a somewhat darker head.

Subspecies *æneas*, nov.

Evidently tolerably closely resembling *hypoleucos* but a larger and more heavily pigmented form. Back dark brown; the top of the head much darker than in *achates*, *iulus* and *priamellus* and not nearly so sharply contrasted with the shoulders but passing into reddish-buff in front. Arms very dark, deep brown close up to the body but black in front on the shoulder and from above the elbow to the finger-tips on the inner as well as on the outer side. Outer surface of legs like the arms, brown close to the hip but black in front and from above the knee to the tips of the toes, black also on the inner side up to the pubic region. Tail blackish throughout. Whiskers, throat, flanks and lower surface buffy or reddish-white, this hue also extending along the inner surface of the upper arm and obscurely down the middle of the pubic area between the thighs.

Distribution. S. Coorg from Makut, below the Ghats, 250 feet, to Wottekolli, 2,000 feet (G. C. Shortridge).

Type. Adult male from Makut, B.M. No. 14.11.18.23.

The description given above was taken from a sub-adult male from Makut and an adult female from Wottekolli. They resemble *hypoleucos* in general coloration but certainly differ from it in the blackness of the hairs on the inner side of the thigh making a sharp contrast with the white of the belly. A young male with the head and body 24 inches and the tail 32 inches is not so heavily pigmented on the limbs and in this respect comes nearer *hypoleucos*. The head of *æneas* also seems to be considerably darker than in *hypoleucos*; and the only known example of the latter, an old male, is considerably smaller than the adult male of *æneas* as the following measurements show :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
Makut, 250 ft., ♂	28″	37″	7″	1½″	25½ lbs.
Wottekolli, 2,000 ft., ♀	25″	36″	6½″	1½″	22 lbs.

The skulls of these two adult examples measure, in millimetres, as follows :--

Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
♂	112	40	32	68	...
♀	106	38	32	66	86

It seems singular that two races of *Pithecus entellus* should occur in Coorg, namely, *elissa* at Nagarhole in the south-eastern part of the province and *æneas* at Makut and Wottekolli in the southern part, and both at nearly the same elevation. Nevertheless the two are readily distinguishable by their colour and it seems probable that *æneas* inhabits a zone with much heavier rainfall than *elissa*.

Subspecies *elissa*, nov.

Presbytis entellus anchises. Dollman, *Journ. Bomb. Nat. Hist. Soc.*, xxii, p. 494, 1913. Not *anchises*, Blyth.

Indistinguishable in general colour from some examples assigned to *achates* and no two of the four specimens examined exactly alike. But differing apparently from *achates* in having somewhat softer, silkier hair, a distinct tuft or crest on the crown of the head and in the uniformly white or whitish-tint of the cheeks, the dusky hue between the eye and the ear, present in *achates* and *iulus*, being absent.

Distribution. Nagarhole, S. E. Coorg (2,600 feet).

Type. Adult ♀, B. M. No. 14.11.18.16.

The chief interest of this form lies in the presence of the crest or tuft on the crown of the head, which was noticed by Mr. Shortridge, the collector, and is apparent on all the skins. A similar crest has hitherto been regarded, so far as the Indian and Ceylonese langurs are concerned, as distinctive of the race described below as *pallipes* and generally known as *priam* or *priamus*. I do not attach very much importance to this crest as distinguishing *elissa* from *achates* ; but its development in *elissa* unquestionably lessens the systematic value that has been attached to the development of a similar crest in *pallipes* and it is worthy of special attention on that account alone.

The measurements in inches and the weight of two adult females and of an immature male are as follows :—

Sex	Head and Body	Tail	Hind foot	Ear	Weight
♂	24″	36″	7⅓″	1½″	20 lbs.
♀	25″	36½″	7″	1½″	23 lbs.
♀	24½″	31½″	6½″+	1½″	18¼ lbs.

The following are the dimensions of the skulls of the same specimens :—

Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
♂	105	35	32	63	...
♀	103	36	33	67	79
♀	99	34	30	65	81

In the skull of the male the canine and the last molar, although through the bone, are only half up ; and since it may be assumed that the monkey was not full sized, the conclusion that *elissa* is about equal to *achates* in size is justifiable.

Subspecies *priamellus*, nov.

Colour of upper side sepia brown, similar to that of *achates*, but with the head and cheeks dirty white, without any dark pigment on the cheeks between the eye and ear, with the outer side of the arms and legs uniformly brown, about the same tint as the back, this colour blending with that of the hands which are not black and only slightly darker than the arm, while the feet are greyish-brown and the same colour as the leg below the knee, the tail being the same colour as the back with its terminal portion whitish. The back of the thighs, the whole of the underside of the body and the inside of the limbs clothed with white hairs.

Distribution. Shernelly in Cochin.

Type. Adult male, collected for the Survey by Mr. Riley O'Brien. B. M. No. 21.11.5.7.

One specimen only was obtained and no measurements were recorded.

The chief interest of this specimen lies in the resemblance it shows to *achates* and *pallipes*. It approaches *achates* in the paleness of the head as compared with the back but differs in the absence of blackness from the hands and feet, and it resembles *pallipes* in the hands and feet being the same tint as the arm, and legs but differs in the colouring of the head. There is also no trace of a crest on the head.

The skull has prominent brows and the interorbital nasal region is concave, being vertical above and projecting below at an angle of about 135°; but the most noticeable peculiarity about the skull is the shape of the nasal orifice which instead of being long and narrow, as is typically the case in the other races of *entellus*, is wide, the width considerably exceeding half the greatest height. (Text figs. 8B and 9B.)

The dimensions of the skull are as follows :—

Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
105	38	31 +	69	82

Since the skull attests the full maturity of the specimen, it is clear that this race of langur is much smaller than *pallipes*, considerably smaller than *achates* and as large only as *iulus* ; but from the structure of the skull and the colour of the hands and feet I am disposed to think this langur is more nearly related to *pallipes* than to *achates* or *iulus*.

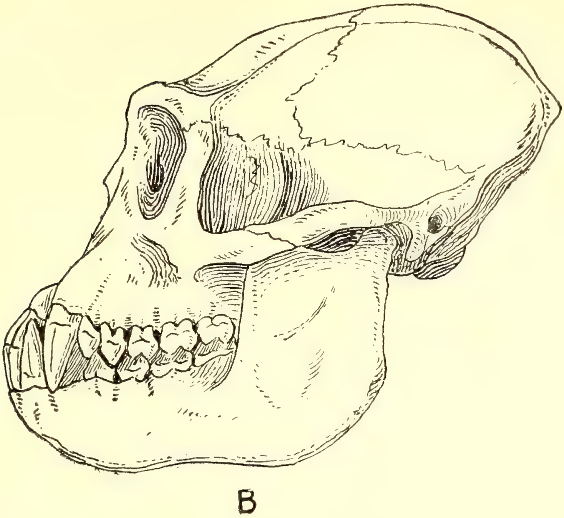


FIG. 8B.—Skull of *Pithecus entellus priamellus* from Cochin. ♂ ad. Two-thirds nat. size.

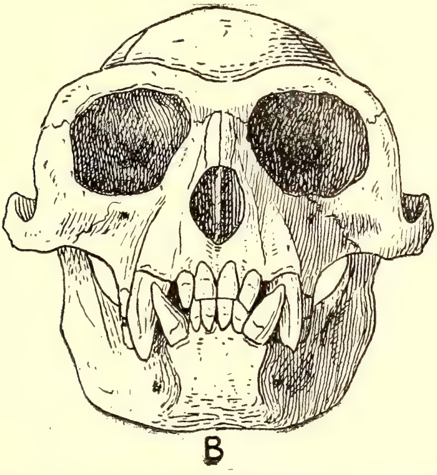


FIG. 9B.—Skull of *Pithecus entellus priamellus* from Cochin. ♂ ad. Two-thirds nat. size.

Subspecies *pallipes*, Blyth.

Semnopithecus pallipes, Blyth, *Ann. Mag. Nat. Hist.*, p. 312, 1844 (April).
Semnopithecus priam, Blyth, *Journ. As. Soc.*, *Bengal*, xiii, pp. 470 and 476, 1844 (after October).
Presbytis priamus, Blyth, *Journ. As. Soc.*, *Bengal*, xvi, p. 732, pl. liv, fig. 1, 1847.
Semnopithecus priamus, Anderson, Blanford and most recent authors.
Presbytis thersites, Blyth, *Journ. As. Soc.*, *Bengal*, xvi, p. 1271, pl. liv, fig. 3, 1847.

Tolerably closely resembling typical *entellus* in size and general colour, the back and outside of the limbs varying from uniform sepia brown to slaty-grey, the crown of the head being brown and hardly contrasted with the tint of the shoulders, although frequently contrasted with the whiter hue of the cheeks and brow ; but the hands and the feet are practically the same colour as the arms and the legs and not blackened as in *entellus*. Also the hair of the crown is typically raised into a compressed crest or tuft. The tail is like the back in colour except its extreme tip which is grey or buff and the whole of the under side, the inside of the limbs and the backs of the thighs are white or whitish.

Distribution. Southern India, the Coromandel Coast from Nellore southwards, to, according to Blanford, Trivandrum and up the Nilgiri Hills to a height of 6,000 feet, as reported by Davison. Also Northern and Central Ceylon as far south as Trincomali and the Kandyan Hills.

In regarding this langur as a distinct species from *entellus*, Blanford relied, so far as external characters are concerned, upon the pale hands and feet and the presence of the crest on the head. But the importance of these characters is lessened by the presence of pale hands and feet in *priamellus* and in the form named *anchises* by Blyth, the presence of a similar crest in *elissa* from S.E. Coorg, and its absence in the Ceylonese examples of *pallipes* named *thersites* by Blyth.

The following table shows the approximate dimensions in inches and the weights of some of the specimens obtained by the Mammal Survey :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
Cheddikulum, Ceylon, ♂	25″	36″	7½″	2″—	29½ lbs.
,, ,, ♂	23¾″	32″	7½″	2″—	25¼ lbs.
Mahendragiri Range, S. Travancore, ♂ ...	23″	26″	7½″	2″	...
Mankeni, Ceylon, ♀ ...	20″	34¾″	6″	1½″	15 lbs.
,, ,, ♀ ...	20″	30″	6½″	1½″	13 lbs.

The Ceylonese examples were collected by Major E. W. Mayor in the northern and central provinces of the island, and the single example from S. Travancore by Mr. R. S. Pillay at Avambo at the foot of the Mahendragiri range.

These measurements show that the adult males are about the same size as *entellus* and *achates*, and suggest that the females are smaller ; but the two females measured are shown by their skulls to be scarcely full grown. Nevertheless, the skull of an adult female, recorded below, from the Nilgiri Hills, is considerably smaller than that of a male from the same locality, thus showing that in *pallipes* the sexual differences in size are as marked as in the skulls of typical *entellus*.

The measurements in millimetres of the available skulls are as follows :—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
Mahendragiri Range, ♂ ...	123	43	32	78	95
Nilgiri Hills, ♂ ...	122	45	34	78	97
Cheddikulum, ♂...	117	42	31	74	90
Nilgiri Hills, ♀ ...	100	36	30	65	82
Mankeni, ♀ ...	100	32	30	64	75
,, ♀ ...	100	33	30	63	78
,, ♀ ...	—	34	30	60	77

But the measurements convey no idea of the profound variation in the shape of the skulls. The skull of the adult male, collected by Davison in the Nilgiri Hills, which is certified by Thomas and Blanford to have been taken from the head-skin of a specimen of *pallipes* (*priam*), has the nose prominent, the back of the cranium high, the plane of the occiput steeply sloped and the lower jaw very massive, with the symphysis strongly inclined. But in the skull of the male from the Mahendragiri Range the nose is almost vertical, the back of the cranium is much less raised, the occipital plane is less steeply sloped, the lower jaw is less massive and its symphysis is more vertical. (Text figs. 10A and 10B.)

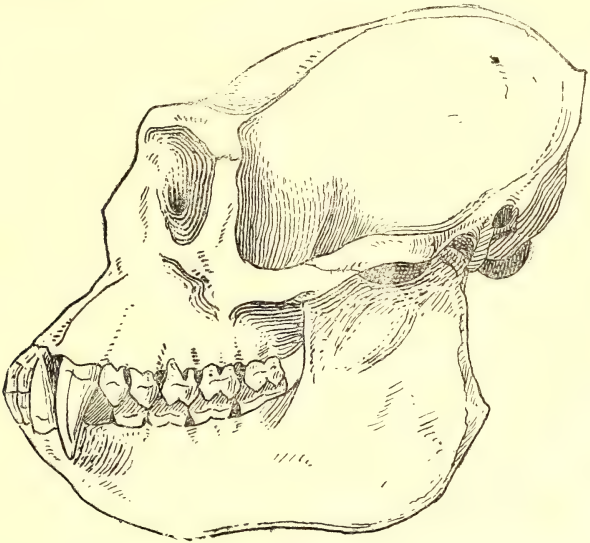


FIG. 10A.—*Pithecus entellus pallipes* from the Nilgiri Hills. ♂ ad.
Two-thirds nat. size.

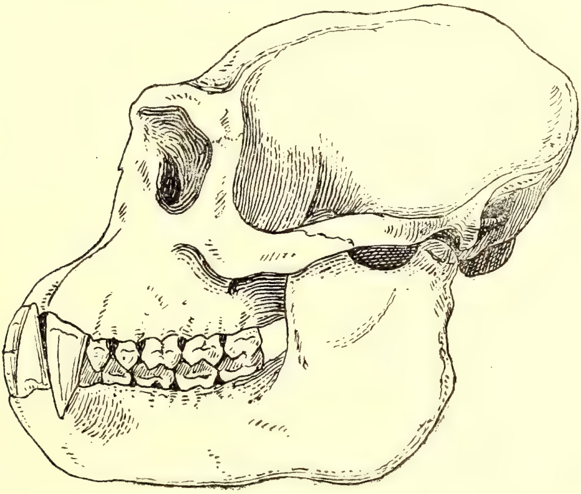


FIG. 10B.—*Pithecus entellus pallipes* from the Mahendragiri Range. ♂ ad.
Two-thirds nat. size.

The female skull from the Nilgiri Hills (Davison) has the nose nearly vertical, the cranial portion short high and rounded and the lower jaw massive, whereas the female skulls from Mankeni in Ceylon have the facial portion less steep, the cranial portion lower and flatter, especially in one of the specimens and the lower jaw much less massive.

The skulls of adult males of *pallipes* differ from those of typical *entellus* in having the face lower and the upper jaw less massive ; but they resemble in that respect, as stated above, the skull of an adult male of *entellus* from Deesa in Palanpur. This last-mentioned skull, indeed, is very like the skull of *pallipes* from the Mahendragiri Range except for the prominence of the nose, and in that respect it closely resembles the skull from the Nilgiri Hills.

The names *pallipes* and *priam* were given in the same year to this langur and Anderson, Forbes and Elliot, assuming apparently that *priam* was the first to be published, added *pallipes* to it as a synonym. But since *pallipes* was published in April and *priam* not until after October, it is clear that *pallipes* is the older name and by the law of priority must, if properly introduced, be adopted. Blanford omitted to quote it, possibly regarding the name as invalid. But Blyth applied *pallipes* to the 'reputed' Entellus monkey of Southern India which is quite different from the true *entellus*. Technically perhaps it may be claimed that this is not a description ; but since Blyth had a skin and knew it came from Southern India, it is clear that by reputed he meant 'so-called' and not 'surmised' ; and what he said about this langur was quite sufficient to enable it to be identified with certainty. This apparently was the opinion of Anderson who quotes *pallipes* in the synonymy of *priamus* without any query as to the validity of the description or doubt as to the identity of the species. His verdict, being that of the first reviser, I have adopted.

The only other name to be considered is *thersites* given by Blyth to a langur from Nuera-Kalawa, west of Trincomalee in Ceylon, differing from *pallipes* (*priamus*) in having no crest on the crown. Blanford interrogatively added *thersites* to the synonymy of the Ceylonese langur *cephalopterus*, now known as *vetulus* ; but Blyth was much too good a zoologist and knew the Indian langurs too well to have overlooked the very obvious differences between the *cephalopterus* and the *entellus* group of langurs ; and it is quite clear from his figure and description of *thersites* that it belongs, as he said, to the latter category. It is most emphatically an *entellus*-like, not a *cephalopterus*-like monkey, and I have no doubt that it is identical with *pallipes* (*priam*), despite the absence of the crest. Kelaart also obtained a specimen in Ceylon without a crest.

Two langurs alleged to be representatives of these so-called species are figured side by side on Wolf's plate of Ceylon Monkeys in Tennent's *Natural History of Ceylon*, 1861. Wolf was a first-rate animal artist and his illustrations on this plate are so good that it may be inferred that they were drawn either from living specimens or skins. Now it is interesting to note that the top left-hand figure representing *thersites*, alleged to have no crest, has a crest as large as that in the Survey specimens, whereas the top right-hand figure, representing *priamus*, has a high peaked crest larger than in any example of this langur I have seen, although there is a good deal of individual variation in the size of the crest. I think it probable that the crest is actually or potentially present in all individuals of the race and that its occasional absence is due to moulting.

Pithecus senex, Erxleben.

Cercopithecus senex, Erxleben, *Syst. Regn. Anim.*, p. 24, 1777.
Cercopithecus vetulus, Erxleben, *tom. cit.* p. 25 (in part).
Cercopithecus kephalopterus, Zimmermann, 1780=*Presbytis*, *Semnopithecus*.
Pygathrix or *Pithecus cephalopterus*, Anderson, Blanford, Elliot, Wroughton and others (in part).
Pithecus vetulus, Hinton, *Ann. Mag. Nat. Hist.* (9), xi, p. 506, 1923 (in part).

Resembling, except in albino specimens, the Langurs of the *Entellus*-group in the deep blackish-brown hue of the newly born young, but differing in the absence of the frontal whorl-like parting on the forehead, the presence of a patch of shorter paler hair upon the croup or loins, the black or brown tint of the under side and, usually at all events, in the presence in the female of a white or whitish patch of varying extent on the pubic region below the callosities, and on the inner side of the thighs.

Distribution. Southern India and Ceylon.

The closeness of the affinity between the Langurs described below as subspecies of *Pithecus senex* was well-known to Blyth, Anderson and other authors. Hence the grouping of them under one specific name is not a novel idea, although most modern authors have followed Blanford in admitting three species.

The skulls, so far as my observations go, present a considerable amount of individual and but little subspecific variation. The sketch of the side view of the skull of *P. senex nestor* will give an idea of the general form. It will be noticed that the brows are not nearly so pronounced as in the subspecies of *Pithecus entellus*, so that the plane of the orbit is not vertical but inclined backwards. But the prominence of the brow and consequently the slope of the nose and the inclination of the orbit vary a good deal individually. (Text fig. 11A).

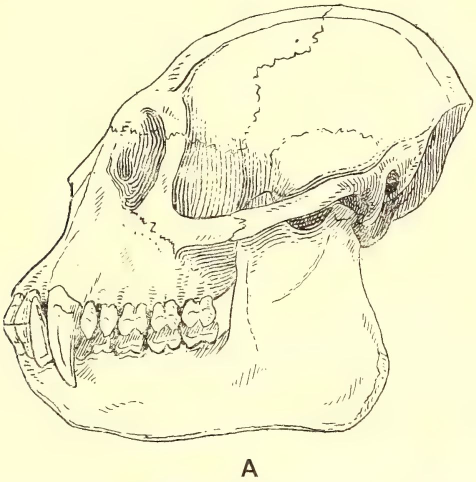


FIG. 11A.—Skull of *Pithecus senex nestor* from Panadura. ♂ ad. Two-thirds nat. size.

The skulls may be here dealt with comprehensively. There will be no occasion to do more than refer to them very briefly under the subspecific headings.

The following are the measurements in millimetres of a few :—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width
johnii, ♂ (juv.), Cochin ...	108	32	30	65	80
johnii, ♀, Nilgiris.	108	36	31	64	83
johnii, ♀, Cochin.	95	30	30	...	...
vetulus, ♂, Anasigalla ...	103	34	26	61	74
nestor, ♂, Panadura ...	98	33	26	60	75
nestor, ♀, Panadura ...	94	32	26	60	72

These measurements suggest that the South Indian subspecies, *johnii*, has a considerably larger skull than the Ceylonese races *vetulus* and *nestor* ; but I have seen a male skull belonging to a form from Ceylon closely allied to *vetulus* and *nestor* which gave the following measurements :—Total length 109, length of palate 39, of upper molars 28, orbital width 65, zygomatic width 80.

KEY TO THE SUBSPECIES OF *Pithecus senex*.

- *a* General colour white or whitish ... ... *senex*.
- a^1 General colour brown or black.
  - *b* Crown and whiskers tolerably uniformly coloured buff or brown ; the throat darker than the crown ; general colour black ; the tail also mainly black ... ... *johnii*.
  - b^1 Crown and whiskers contrasted, crown brownish or buff, whiskers white or whitish ; throat lighter than crown ; tail greyish to brownish, not black.
    - *c* Coat thick and shaggy ; head and croup not sharply distinguished by colour from the back ... ... *monticola*.
    - c^1 Coat shorter and smoother ; head and croup more distinctly defined from colour of back in adult.
      - *d* General colour black, with head darker but croup patch silvery grey ... *vetulus*.
      - d^1 General colour brown, with head paler and croup patch grey to grey brown *nestor*.

Subspecies *senex*, Erxleben.

Cercopithecus senex, Erxleben, *Syst. Regn. Anim. Mamm.* p. 24, 1777.
Semnopithecus senex. Schlegel, *Mus. Pays Bas, Simiæ*, p. 53, 1876 ; Blanford, *Faun. Brit. Ind. Mamm.*, p. 35, 1888.
Presbytis albinus, Kelaart, *Prodrom. Faun. Zeyl*, p. 7, 1852 ; *id*, *Journ. As. Soc., Bengal*, xx, p. 182, 1852.

Fur dense, wavy, of a nearly uniform white colour, with only a slight dash of grey on the head ; whiskers white, full and pointed laterally ; hands and feet with long white hairs overhanging the tips of the fingers and toes. Face and ears black, eyes brown ; palms and soles flesh-coloured.

Distribution. Ceylon, Matelle (Matale).

Erxleben gave the name *senex* to a white Ceylonese monkey referred to by Knox[1] as another sort of monkey, milk white both in body and face. This no doubt was a pure albino possibly, perhaps probably, belonging to one of the Ceylon races of Langurs recorded below ; and since *senex* has page priority over *vetulus*, the former name must, according to the rule, be adopted, although it was unfortunately probably applied to a variety. The available evidence does not at present enable us to say to which, if to any, of the now well-known races *senex* should be applied. In adopting the name I have, therefore, followed Schlegel who seems to have been the first reviser to affix *senex* to a definite type of Langur from Ceylon. This was represented by a specimen brought by Temminck from that island and presented to the Leyden Museum. Schlegel described it as yellowish-white, washed with brown on the back and with red on the upper side of the head and nape. Blanford, who saw what was no doubt the same specimen in Leyden, endorsed, with unimportant modifications, Schlegel's description of the colour, adding that the face and ears were black, the palms and soles flesh-coloured, the fur dense and wavy, the whiskers full and the toes well haired. He compared its dimensions to those of *P. ursinus* (=*monticola*) and the thickness of the coat bears out the view that the two are similar. Although the blackness of the face and ears and the wash of colour on the head and back show that this specimen is not so complete an albino as the white langur recorded by Knox, Schlegel's application of the name *senex* need not on that account be set aside.

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[1] *Historical Relation of Ceylon*, vol. i, Ch. VI, p. 25, 1681.

But many years before Schlegel's time, Kelaart gave the name *albinus* to a whitish Langur received as a living animal from Matelle, and his description applies so closely in a general way to Temminck's specimen, although the latter was paler, that there seems no reason to doubt that Temminck and Kelaart had very similar varieties of the same Langur. I have, therefore, followed Schlegel in adding *albinus* to the synonymy of *senex* and have reproduced Kelaart's description and fixed upon Matelle as the typical locality for *senex* in view of the possibility of the existence now, or in the part, of a very pale race akin to the darker races, *vetulus, nestor* and *monticola*. This possibility must be borne in mind because it is in a measure supported by an old record by Spence Hardy, quoted by Sir J. Emerson Tennent, to the effect that a troop of white monkeys was seen at Dambool on the rock upon which the great temple stands and by Blanford's statement that white monkeys might be seen occasionally on the Ceylonese mountains in parties of three or four, always apart from other monkeys.

On the other hand, Sir Emerson Tennent had a white langur, taken between Ambepasse and Kornegalle, where they were said to be numerous; and this specimen, according to him, had all the characters of *cephalopterous*, apart from its colour, which was strikingly white with the face and eyes black. He was told, moreover, that white monkeys had been seen near the Ridi-galle Wihara in Seven Korles and also at Tangalle. This suggests that the lowland form, probably *vetulus*, is addicted to albinism.

Subspecies *vetulus*, Erxleben.

Cercopithecus vetulus, Erxleben, *Syst. Regn. Anim. Mamm.* 3, p. 25, 1777. (= *cephalopterus* of later authors).

Pithecus vetulus vetulus, Hinton, *Ann. Mag. Nat. Hist.* (9), xi, p. 509. 1923.

Colour of back from nape to croup black finely speckled with grey; croup grey or silvery, this tint spreading on to outside of thighs and root of tail; tail greyish to greyish-brown; arms and legs at least from the knees downwards black like the back; head brown above; whiskers and throat mostly white but whiskers brown at the ends and some brown on the middle of the throat; under side and inside of limbs black, but some white on the pubic region beneath the callosities in the female.

Distribution. S. Ceylon from about Ranna through the Udugama Hills in the Galla District and up the western coast to the Kala Ganga River; probably also in Ratnapura.

This information regarding the range of this race was supplied by Mr. W. W. A. Phillips to Mr. Hinton, who quoted it in his paper.

The following table gives the approximate dimensions in inches of some examples of this race :—

Locality and Sex	Head and Body	Tail	Hind foot	Weight
Kalutara, ♂	24 —	28″—	6½″—	...
Anasigalla, ♂	21½″+	29″+	6½″—	12½ lbs.
Matugama, ♂	22″+	30½″+	7″—	...
Kalutara, ♀	23″+	27½″+	6″	..
Kalutara, ♀	22″	28″	6″—	11½ lbs
Anasigalla, ♀	21″	30″	6″	...

Subspecies *nestor*, Bennett.

Semnopithecus nestor, Bennett, *Proc. Zool. Soc.*, p. 67, 1833.
Semnopithecus kelaarti, Schlegel, *Monogr. des Singes*, p. 52, 1876.
Pithecus vetulus nestor, Hinton, *Ann. Mag. Nat. Hist.* (9), xi, p. 510, 1923.
Pithecus vetulus phillipsi, Hinton, *ibid.*

Differs from *P. senex vetulus*, in having the blackish hue of the upper and under sides and limbs replaced by deeper or lighter sepia brown which, toning more with the paler areas on the head and croup, lessens their conspicuousness. The whiskers, however, are white and conspicuous, the head is, ochraceous or buff, and the patch on the croup varies from silvery-grey to pale brown.

Distribution. Southern Ceylon ; the Panadura and Horana Districts, north of the Kala Ganga River, and ranging up the west coast to a little way north of Colombo and inland up the Kelani Valley, probably to the foot of the Adam's Peak Range.

This information regarding the range of this race was published by Mr. Hinton from information received from Mr. W. W. A. Phillips ; and Mr. Hinton has shown that it inhabits an area where the annual rainfall is less than in the area inhabited by *vetulus*.

The type of *nestor*, in the British Museum, is a half-grown langur, merely ticketed Ceylon. I cannot, however, distinguish it by any reliable characters from the series of skins, sent by Mr. Phillips, which were described by Mr. Hinton as *Pithecus vetulus phillipsi*.

The type of *phillipsi*, an adult male from Gonopola in the Panadura District, has the back, the arms and the legs sepia brown, with the limbs darkening towards the extremities and turning black on the hands and feet ; the croup patch and tail are grey, the head buffy brown and paler than the back, the whiskers and throat white and the lower side dark brown.

An adult female from Horana in the Panadura District is tolerably similar and has a white patch below the callosities.

Another adult female from Godigamiura in the Panadura District is darker brown both above and below than the type and has the croup patch, not grey and conspicuous, but pale brown as in the type of *nestor*.

The approximate measurements in inches of three specimens from the Panadura district are as follows :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear
Gonopola, ♂	20″	28½″	6½″	1⅓″
Gonabendaluwa, ♀ ...	22½″	31″	6″	1½″
Horanna, ♀	19½″	28″	6″	1⅓″

Subspecies *monticola*, Kelaart.

Presbytis cephalopterus var. *monticola*, Kelaart, *Journ. Roy. As. Soc.* (Ceylon Branch), ii, No. 5, p. 321, 1850, *id. Prodr. Fauna Zeylan*, p. 2, 1852.
Presbytis ursinus, Blyth, *Journ. As. Soc., Bengal*, xx, p. 155, 1851 ; and of Anderson, Blanford, Elliot, Wroughton and other authors quoted under *Semnopithecus*, *Pygathrix* or *Pithecus*.

A large mountain-form closely resembling *P. vetulus nestor* in colour but with shaggier longer coat, and the pale patch on the croup usually at all events less distinctly defined. Colour varying from deep blackish-brown to sepia brown on the back and limbs. Summit of head and nape always brown ; whiskers, throat and chin grey or white and contrasted with the colour of the head and chest. Face black, bordered with black hairs and with a line of black hairs between the eyes and expanding on the summit of the nose between the nostrils.

Distribution. Mountains of Southern Ceylon.

Examples of this fine langur are rare in collections. The British Museum has four examples only. An adult male from Adam's Peak (*S. B. Bell*) is dark blackish-brown, blackening on the hands and feet. The croup patch is paler, sepia brown ; the whole of the crown of the head and the nape are also paler sepia brown and, like the croup-patch, are sharply set off by the darker hue of the back ; the whiskers, throat and chin are grey ; the tail, which in its basal half is like the croup patch, becomes greyer in its terminal portion.

Another adult male from Pattipola in the Central Provinces, where it was shot at an altitude of 6,200 feet by Major E. W. Mayor, is considerably paler brown than the one from Adam's Peak. Hence the croup patch and the crown of the head are much less conspicuous and the hands and feet are brown.

An adult female from Hakgalla Uva, 5,600 feet (*Major E. W. Mayor*) is also paler than the male from Adam's Peak but somewhat darker than the one from Pattipola. The patch of white hair below the callosities is quite distinct.

The fourth example, ticketed merely Ceylon and received from Dr. Kelaart, is too old and worn to call for comment.

Hitherto this langur has always been cited as *ursinus* ; but *monticola* appears to be the older of the two names. It was given by Kelaart to a langur from the higher part of the Kandyan Province, Nuwara Eliya, which was described as similar to typical *cephalopterus* (= *vetulus*) but without white on the inner side of the thighs and on the rump. It was also said to be larger and darker than its low country relative, with a rufous tinge on the neck and longer and more wavy hairs.

The following approximate measurements in inches are available from two examples collected by Major E. W. Mayor :—

Locality and Sex	Head and Body	Tail	Hind foot	Weight
Pattipola, 6,210 ft., ♂ ...	23⅘″	24¾″	7″	20 lbs.
Hakgalla Uva, ♀ ...	21½″+	26½″+	6½″	16½ lbs.

The type of *monticola*, a female from Nuwara Eliya, was probably young since, according to Kelaart, its head and body measured only 17 in., the tail being 26 in. and the hind foot 6 in. But he sent, he tells us, a larger specimen to Blyth, which was described by Blyth as *ursinus*, as Kelaart stated in 1852.

The largest specimen, so far as I am aware, of which the dimensions have been recorded, was measured by Elliot. The head and body were 28 in., the tail 31 in. and the hind foot 7 in. It also came from Nuwara Eliya ; but the measurements were taken from a dried and probably stretched skin.

Setting aside Elliot's specimen, it will be observed that, according to Major E. W. Mayor's recorded measurements, *monticola* is no larger than *P. s. vetulus* and *P. s. nestor*. It is true that made-up skins of *monticola* look larger, but this is no doubt largely due to the thickness of the coat. There is nevertheless considerable difference between *P. s. monticola* and *P. s. vetulus* in weight, *monticola* : being much heavier. Moreover according to the measurements recorded by Hinton in his paper quoted above, the skull of *monticola* (=*ursinus*) is about 10 mm., nearly half an inch longer than the skulls of *vetulus* and *nestor*.

Subspecies *johnii*, Fischer.

Simia johnii, Fischer, *Syn. Mamm.*, p. 25, 1829.
Semnopithecus, *Presbytis* or *Pithecus johnii* or *johni*, Anderson, Blanford, Elliot and most recent authors.

A mountain-race of large size, nearly as large as *monticola* but with the coat shorter, closer, blacker and more glossy on the body and limbs, the general colour being jet black, or nearly so, above and below. It differs also from *Pithecus senex monticola* in the uniform buff-brown tint of the long hairs of the crown and of the whiskers and throat, there being no contrast in tint between the whiskers and crown ; the tail also is nearly black and not very noticeably paler than the middle of the back, as in the Ceylonese forms.

Distribution. Mountains of Southern India, the Anamalai, Palni and Nilgiri Hills and the Western Ghats from Coorg to Cape Comorin.

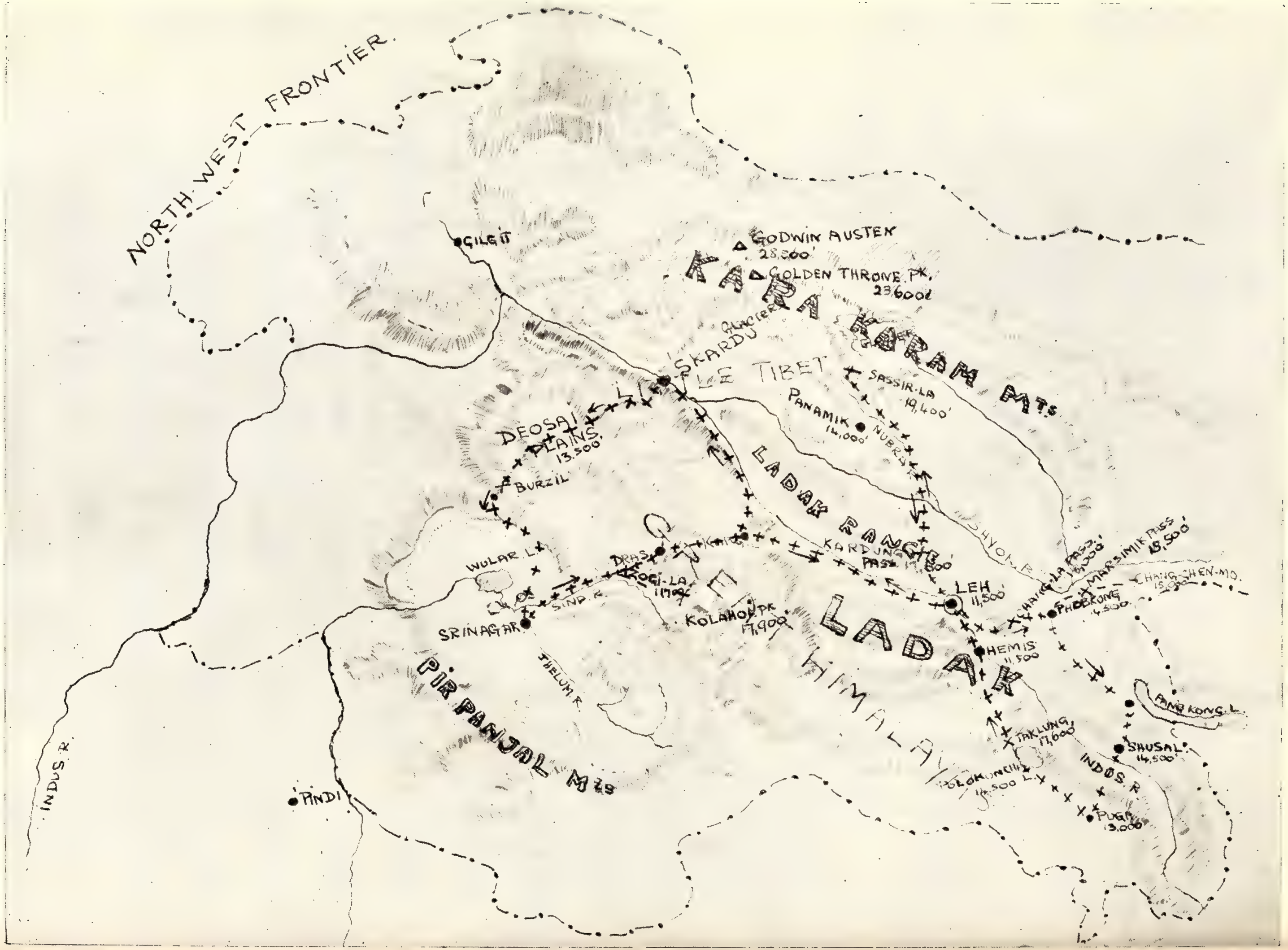
The following table gives the approximate dimensions in inches of examples of this langur collected for the Mammal Survey by Mr. G. C. Shortridge and Mr. Riley O'Brien :—

Locality and Sex	Head and Body	Tail	Hind foot	W
Brahmagiri Hills, S. Coorg, 2,780-5,138 ft., ♂	26″	30½″	7″—	21½ lbs.
Kumblacodie, Cochin, 3,500 ft., ♂ ...	23″	34½″	7½″	...
Anamaad, S. Malabar, 3,200 ft., ♂ ...	22½″	37″	7¾″	...
Kukkal Shola, Palnis, 6,100 ft., ♀ ...	24″	32″	7″	25 lbs.

Made-up skins of this langur appear to belong to a considerably larger form than the typical Ceylonese *vetulus* and *nestor*. But the dimensions show that there is not very much difference. It is, however, a heavier animal as indicated by the weight. I have not seen the skull of a fully adult male, the one measured above 268 having the occipital suture open and the upper canines hardly longer than in the female. But the skull of the fully adult would certainly be larger than in the Ceylonese races *vetulus* and *nestor* and the teeth are larger.

Although this langur has always hitherto been regarded as a species distinct from the related Ceylonese langurs, it does not appear to me that its characteristics should be given more than subspecific importance.

(*To be continued*)


NORTH WEST FRONTIER
GILGIT
GODWIN AUSTEN 28,500'
GOLDEN THRONE PK. 23,600'
KARA KORAM MTS
GLACIER
SKARDU
LE TIBET
SASSIR-LA 19,400'
PANAMIK 14,000'
NUBRA
DEOSAI PLAINS 13,500'
BURZIL
LADAK RANGE
KARDUNG PASS 17,800'
SHYOK R.
WULAR L.
DRAS
ZOGI-LA 11,300
SIND R.
SRINAGAR
KOLAHOI PK. 17,900
LEH 11,500
HEMIS 11,500
LADAK
CHANG-LA PASS 18,000'
MARSIMIK PASS 18,500'
CHANG-CHEN-MO 15,000
PHOBRONG 14,500
PANG KONG L.
SHUSAL 14,500'
TAKLUNG 17,600
INDUS R.
POLOKONGKA 14,500
PUGA 13,000
HIMALAYA
JHELUM R.
PIR PANJAL MTS
PINDI
INDUS R.

Route + + + + +

A COLLECTING TRIP TO LADAK

BY

V. S. LaPersonne

Asst. Curator, Bombay Natural History Society

Part I

(*With a map and five plates*)

It was a happy opportunity that allowed me to hitch my cart behind that of Col. Meinertzhagen's, when he organized a collecting trip to Ladak and on to the borders of Chinese Tibet for the purpose of acquiring a thorough knowledge of the resident bird life at the higher altitudes, and also authentic proof of the migratory species that cross the Great Himalayas and breed in the highlands of Ladak and Little Tibet. The success of this collecting enterprise and the subsequent recognition of new species added to the fauna of Ladak was the work of a congenial employer and friend and a first-class organizer. It is to him I owe whatever knowledge I have of systematic collecting and of preparing bird skins that will be a 'thing of joy for ever.'

The path of a bird collector is not always strewn with roses. His peregrinations may take him, at times, well beyond the pale, where perhaps, through sheer malice, he may see a 'snow man' and come back to us with photographic proofs of human foot-prints in the snow.

On the other hand the field is infinitely varied. There are hunting grounds to suit all tastes. The arid desert, the tropical forest with its varied and multi-hued denizens, or the bleak glacier-hung mountain top.

Col. Meinertzhagen and I left Pindi on February 21 and passing up the picturesque Jhelum Valley arrived in Srinagar on February 27, having collected a good many migrants on the way.

We left Srinagar on March 23 and crossing over the Great Himalayas at the depression known as the Zogi-la Pass, followed the Indus Valley and reached Leh on the 6th May. Leaving Leh on the 17th May we crossed over the Ladak range by the Changla and Marsimik la passes and reached Changchen-Mo Valley on the 31st May.

Retracing our steps we made a wide detour, skirting the Pangkong Lake to Shushal and thence crossing the Indus reached Puga on June 20. Returning to Leh we struck north and arrived at the foot of the Kara Koram Range on July 22.

We returned again to Leh and worked down the Indus to Skardu in Baltistan on August 13. Thence we returned to Kashmir by way of the Deosai Plateau and reached Srinagar on September 5.

During the period of collecting we covered over 2,000 miles and in the course of our travel reached an altitude of 21,050 ft. in the Kara Koram.

The Vale of Kashmir is described as a saucer-shaped valley between the Great Himalayas and the Outer Himalayas or the Pir Panjal

Mountains between the Great with a length of about 80 miles, a breadth of 24 miles, and a mean altitude of 5,600 feet above sea-level, corresponding in latitude to Palestine, the Mediterranean and California. Thus it has a blend of temperatures which should compare favourably with any other summer resort in the world.

For its genial beauty Kashmir should stand alone, for here you have a combination of lakes, the quiet beauty of cultivated fields and gardens, and a snow-capped mountain range which completely encircles the luxuriant valley.

It would be as great a mistake to generalize on the character of the Kashmiri, as to accept the theory that all Kashmiri women are beautiful. Yet if we must err, let it be on the side of caution. Sir Francis Younghusband, for many years Resident of Kashmir, has written a very interesting book on this province, and, as a man who knows what he is talking about says, 'A Kashmiri soldier is almost a contradiction in terms. There is no such thing. They will endure and suffer but they will not fight. And they are very careful of the truth.' Col. Meinertzhagen added a rider to that by saying, 'They are so careful of the truth that they seldom use it.' However, it is to their splendid endurance there we owe the success of our enterprise.

We had arrived in that 'Valley of Bliss' just when the almond blossoms were in bloom and Kashmir was warming up after a rather severe winter. We had intended staying in an hotel, but this became impossible. Being the earliest visitors we were preyed upon by every shopkeeper who had anything to sell. The climax of Col. Meinertzhagen's patience seems to have been reached when a none too clean fellow offered to give him a Turkish bath!

The 'Season' had not begun when we arrived in Kashmir and the houseboats were piled up along the banks. The Kashmiri boatman claims Noah as his ancestor and if, as Younghusband says, 'they didn't borrow the pattern of their boats from Noah, he must certainly have borrowed it from them.' They are known as MANJIS and live entirely on their boats with their families and cattle, and one can picture the squalor when all agree that the Kashmiri could make Kashmir prefection if only he would wash. We engaged a houseboat which gloried in the name of 'Arabella' but nothing else happened; and slipping anchor from a regular hulabaloo of 'Papier Mache Sir.' 'Shampoo—furst Class?' and one or two pointed remarks as 'Hair cut and Shave Sir?' we worried our way down stream through the crowded waterways to the accompaniment of frantic yells of our boatmen and a return 'cuss fire from Kashmiri bargees' wives, which if understood suits the circumstances down to the ground.

We glided down the river passing the Maharaja's Palace and just beyond the precincts of the city a fair amount of dead horses and cattle, which the Kashmiri delights in pushing into the river when their days are done.

The most conspicuous object in the immediate neighbourhood of Srinagar is Takht-i-Suleiman, 'The throne of Solomon' a bare rocky hill rising 1,000 feet from the floor of the valley, and sur-

HOUSE-BOAT *Arabella* ON WULAR LAKE.

SIND VALLEY, ONE OF KASHMIR'S PICTURESQUE SIDE VALLEYS.

Baltal, 9,000 ft., at the Head of the Sind Valley.

Kolahoi, 17,800 ft., a conspicuous Peak in the Great Himalayas, with its Glacier reaching to the Tree-line.

mounted with a Hindoo temple. The view from this height will repay the climb. On one hand the climber looks down on the town of Srinagar, the Venice of the East, with its numerous waterways and gaily coloured boats, following the course of the Jhelum with little hamlets and temples clustered on its banks, and then away over the valley the land rises to the pine-covered slopes and the culminating touch to every Kashmir scene—the snows. Looking in the opposite direction the view is not so extensive. In the foreground the Dal Lake with stately poplars on its shores and on its placid waters the famous Isles of Chenars, mirrored again in its crystal clear depths. Fleecy clouds crept over the snow peaks that strung out in a jagged line against an azure sky while a bluey haze hung over the valley and the sparkling domes of the temples sent back the rays of the setting sun.

We camped in the lee of a craggy hill and had an uninterrupted view across the still waters of the Wular Lake to the stupendous snow-clad mountains, that stretched across the eastern sky. The pass into Ladak and the land of the laughing Bhudda led over these mountains, but was considered impassable at this time of the year. We decided to wait a month, and fill in the time collecting birds in the vicinity.

Few of the summer visitors, in the course of their migration from the plains and foot hills had arrived, though in those quite historic gardens of Shalimar where the 'playing fountains'—never play, the Paradise Flycatcher, or as he is known to the residents of Kashmir the 'Ribbon-bird', with a flash of satin white, darted among the dark green of the chenar trees.

At dawn the call of that game little fellow, the Chukar, who can be relied upon to give a good morning's sport, is echoed back and forth among the hills. Higher up on the pine-covered tops are the haunts of the Koklass (*Pucrasia macrolopha biddulphi*), and the Nutcracker (*Nucifraga multipunctata*).

In the valley the House Crow is entirely replaced by the Jackdaw during winter, and the sight of these birds leaving the valley in thousands every morning for villages along the Jhelum Valley and returning to roost among the chenar trees in the heart of the town, can hardly be missed by any visitor.

With the rise in the temperature and the melting of the snows on the heights, we decided to commence the trek that was to take us into Ladak and allow us to dangle our feet into Chinese Tibet. On the 25th March we bade farewell to the 'Arabella' at the mouth of the Sind River and moved up that beauteous valley, which at any season surpasses in beauty any other side valley of Kashmir. A thick forest of fir covered the northern slopes with glimpses of snow showing through the dark green, and toy-like villages clinging to the lower slopes.

Such natural beauty of scenery, the varied bird life and exhilerating climate enhanced our collecting spirit considerably. Even our local shikari, who usually suffered from a stomach or a backache, 'girded up his loins' to bag the wary Monal Pheasant, though these when brought in were too full of holes and lead to be of much use for specimens or the pot.

Small parties of Tits, Tree-Creepers and Nuthatches, which consisted of *Parus major kaschmiriensis*, *Parus melanolophus*, *Parus rufonuchalis rufonuchalis*, *Sitta europæa kashmiriensis*, and *Certhia himalayana* (?) frequented the forests. The sub-specific rank of this last bird is under discussion as being intermediate between the Himalayan and Turkestan races.

The Orange Bullfinches (*Pyrrhula aurantiaca*) were not uncommon in the fir forests. Col. Meinertzhagen writes of this bird in the *Ibis* of July 1927, 'The brilliant orange of their plumage showed up like some precious stone on the drab dull green of the ground on which they fed. After a moment they would fly up into a tree, soon to return one by one and sit quite still munching small seeds. Their dislike of movement when feeding and when in a tree was due to their inherited consciousness that in such brilliant plumage they would become visible and an easy prey to any feathered enemy.'

As we moved higher up the valley, forest bird life became scarcer.

The few that braved the winter conditions at 8,000 feet were the Brown Dipper, White-capped Redstart, Guldenstadt's Afghan Redstart, and higher still, the White-breasted Dipper.

On the 7th April we left Traghol, 9,500 feet. This was our fourth day in this picturesque valley. Each day brought forth more wonders in mountain scenery ; each turn in the road a surprise. The thick belt of fir trees thinned out ; giving place to the slender hardy birch. Snow lay thick everywhere, at times completely bridging the river, and then one enters Sonamarg. Glaciers move down the flanking mountains, and in spring, the snow having melted, the glacial formation reaching down to the tree line, is a mass of dazzling ice and bare jagged rocks.

Kolahoi, 17,850 feet, its sharp peak conspicuous from any point along the Sind Valley ridge is the highest point in the Great Himalayas. The peak is six thousand feet above the glacial formation, which stretches down to the tree line.

We arrived at Boltal 9,700 feet on the 10th April. It has a delightful dak-bungalow at the head of the Sind Valley, and is completely surrounded by the wildest and grandest scenery of snow, mountain and mist.

This is the stage when the traveller realizes what he is up against. The Zogi-la Pass which crosses the Great Himalayas into Ladak and which is usually open to traffic after the 15th May, was bunged high with snow ; the only alternative was a snow-bound, precipitous ravine that really was a frozen mountain torrent, covered over with snow.

We remained three days here and every day were made acquainted with the awe-inspiring sight of avalanches. With the thawing of the snow, a few tons would rush down the slopes with the roar of an express train.

The traveller can never be too cautious in his plans of an assault on these mountain fastnesses during winter.

He must be up and away before dawn to avoid the avalanches, his face and hands well greased to avoid frost-bite, his feet shod with grass shoes for a firm foot-hold on the frozen surface of the snow, and, as fancy dictates, a flask of rum or brandy, or if this is 'haram,' chocolate will be found an admirable substitute.

At an ungodly hour in the early dawn of Easter Sunday on April 13 when the temperature was below zero—and our circulation almost that—we set out for the assault on the snow-bound ravine. Ten minutes brisk walk brought us to the foot of the ravine.

Here each man readjusted his load and snapped his belt into the 'starvation hole.'

The coolies were dimly visible in the darkness which precedes dawn as they grouped together for a final smoke. Their gnome-like figures stood out against a sombre sky, and little points of light from their cigarettes, stabbed into the darkness. Col. Meinertzhagen gave the signal and we fell into single file and began the assault.

That scramble up the ravine lasted a little over an hour and for the greater part it was a 'fly-on-the-wall' business. To add to the discomfiture, a howling gale, accompanied by a blizzard, tore down the closed-in ravine. 'A gale,' as our cook said, 'guaranteed to disembowel a camel,' or the equivalent to that in Hindustani.

Looking back on the events of that day, my diary helps with the one elucidating word—'Hell,' followed by notes of exclamations, queries and asterisks, which apparently had its soothing effects, and continues 'But still the wind blew, howling over the peaks, the stinging snow finding its way down your neck, in your ears and nostrils. The fine snow being blown from the heights, resembled, as it caught the sun's rays, a spreading white fire.' We topped the pass and paused for a 'breather' and watched the coolies; these gallant fellows who will not fight, but who can be thoroughly relied upon in these mountains, were putting up a final spurt to gain the top, and as they filed past with their 40 lbs. loads, we could not help but cheer.

Physical disasters have made the Kashmiri selfish; tyranny has made him a liar, and superstition has made him timid. Yet, as he swings along, to the lilt of a mountain song, indifferent to the cold or steep ascents, we have nothing but admiration to offer.

We were now in that range of snows, the snowy range *par excellence*, which extends in a southern direction in a line of snowy peaks, seen from Simla, to the famous peaks of Gangotri and Nanda Devi in Garhwal. And we struggled along over a snow-bound freezing cold valley, among the snow clad giants for three days, seeing extremely little of bird life. The winter conditions prevailing in the region, would hardly appeal to any birds, not even to that curious bird which seems to spend its life either flying at ridiculous altitudes or sitting on bare rocks—the Chough.

As we neared Ladak the temperature rose, though the altitude (11,500) remained the same, and on the 16th April we were thankful to see the last of the 'snowy range *par excellence*,' and which, omitting those unrivalled mountains seen from Darjeeling, is second to none.

We fully expected to see, after crossing the Himalayas, a broad undulating plateau stretching away from our feet to the eastern horizon ; instead our vision was plunged into a conglomeration of barren hills, parched valleys and gaunt Bhuddists' monasteries, which seem perched on every peak.

The track now followed the contour of the hills, with not a tree to break the monotony of barren hillside or a river cradled in the valleys. At Molbek the atmosphere, people, and villages entirely change. We were walking now on ' the roof of the world,' among an ancient race, with still more ancient customs. Monuments, prayers and supplications carved and inscribed on stone, are piled high along the caravan route which reaches to Leh, the capital of Ladak.

We put in a few days at Molbek chiefly for the Himalayan Snow Cock (*Tetraogallus himalayanus*) which were quite common on the hills, and secured quite a good series with the help of Tibetan guides who take their pleasures in dead earnest, and appear to delight in seeing you, purple about the gills, climbing to 14,000 or 16,000 feet in pursuit of these birds.

We found that these descended to the river at an early hour of the morning for a drink, and, as the day warmed, moved higher up—at times to the summit of the bare hills—where they roosted during the warmer hours of the day, at elevations of 14,000 and 16,000 feet. They rarely fly, and then only to cross the valley, if hard pressed by a sportsman. They weigh about 5 lbs. and it takes a good knock to bring them down. During the breeding season they utter a long drawn-out whistle—a dismal sound well associated with the dreary isolated haunts of this bird. The limits of the Himalayan species appear to be at 16,000 feet, and roughly all that region south of the main Ladak chain. Further north, the Tibetan Snow Cock replaces the Himalayan.

To refer again to the Tibetan gun-bearer : he has no equal in these hills, possessing, as he does, an unflagging spirit, an unquenchable zeal and a clean sense of humour—but keep to windward of him, for if to his lee you can judge the full extent of his cleanliness! !

The road now follows the course of the Indus and we plunge again into a labyrinth of confined valleys and gorges, shut in on either hand by vertical walls of rock, and emerge with the Indus into a flat bottomed broad valley that gently slopes to the foot of the Ladak range, where the flat roofed houses of Leh crowd around the monastery, as chickens do round a well-fed hen.

Leh, the great emporium of the trade which passes between India, Turkestan and Chinese Tibet, has been the starting point of many an adventurous journey into the last named country. The town does not seem to have much of a historical past. The unwarlike Ladakis, even with nature fighting on their side, were conquered by the rulers of Kashmir. The Kashmiri troops left to garrison Leh were, on one occasion, slaughtered by a strong force of Chinese from Tibet, since when Ladak, though still a province of Kashmir, is ecclesiastically subject to Lhassa, paying tribute, in the guise of presents, to mollify the Chinese who are held in wholesome fear by the Ladakhis to this day.

The Ladakhi, or ' hybrid ' Tibetan is of a mild easy-going disposition, thoroughly honest, with the thinking capacity of a Yak.

A MORNING'S BAG OF SNOW COCK AT MOULBECK, 11,000 FEET.

MARKET PLACE AT LEH, AND THE 'GOMPA' ABOVE, THE WINTER QUARTERS OF THE ECCLESIASTICAL HEAD OF WESTERN TIBET.

Looking through the Gateway of Leh to the Ladak Range.

Leh in Springtime.

The effects of high altitude may account for his wholesome horror for any form of manual labour and he seems fortunate in possessing a spouse who fills the roles of husbandman and handmaid. A part of her dowry is a turquoise studded headgear—the remainder of it—her slave-like willingness to work.

The price of a bride or brides, fluctuates with the supply, and on our visit in 1925, the women constituted 80 per cent of the population of Leh. What a happy hunting ground is Leh for our be-(k)-nighted bachelors of Bombay!

Since time immemorial, man's soul has yearned for a ball of some kind. An 'oblong' one, a wooden one, or even a rag one. But a ball of some description it must be and until he gets it, he is never really happy. The Ladakhi is no exception to the rule. Every fair sized village has its polo ground and though the game, as played in the plains of India, is a tame affair to the one played here, there is a general tendency to adhere to rules.

Throughout the hour's play there is no change of ponies, the game is fast and furious, and the ball never out of play.

Fouls are unknown; in a scrimmage, you may take a 'whack' at your opponent or his horse. On occasions the game is played down the broad main street, and no rule exists preventing an attack from a player who has lain in ambush in one of the shops flanking the polo ground.

The word '*pulu*', which means 'ball' in Tibetan has given rise to the theory that polo originated among the Mongolians, but history tells us that the game drifted from Persia through Turkestan into China and Japan, thence from Tibet to Gilgit and so to the plains.

The earliest records of this 'game of kings' in Tibet seem to tend more to feats of horsemanship and skill with stick and ball, than to the scoring of goals.

The nature of the present game is a mixture of the two. The ball is brought into play, in the event of a goal, in a most skilful manner. A player gallops at full speed down the 'wing' and, near the half way line, still at full gallop, tosses the ball into the air and smites it square towards his opponent's goal.

Being the centre of the trade of these parts, Leh boasts a reasonable sized bazaar and market.

Goods are more often bartered for goods than sold for cash. The Yarkandi from over the Kara Koram arrives in Spring with his caravan of wool and dried fruits, exchanging these for silks and wearing apparel from Kashmir. The Tibetan after a long and arduous journey over wind-swept desolate plains, arrives with his loads of Chinese brocade and quaint ornaments. The Kashmiri floods the market with all conceivable goods, even to the extent of European provisions. The Ladakhi contributes an occasional Yak tail.

Above the market and perched on an impassable rock are the winter quarters of the ecclesiastic head of Western Tibet. Like most monasteries it has an equally impassable 'stairway' leading up to the entrance, but offers no other obstruction to sightseers.

Bhuddhism may not interest everyone of us, and few travellers have the time to 'worry' about such matters. We accept the existence of those silent edifices as part of the abominable landscape and pass on. Yet in those silent evenings, when the clouds have crept up the valley, the monastery sticks out above like an isolated island in a billowy sea; when the still night air throbs with the sonorous convocations from the deep-throated trumpets up in the monastery, when the moon shines down on the unscrutable face of Bhudda—it would almost seem as if Bhudda walks this earth again.

We have not the desire to tackle Bhuddhism, nor the time to dip into dimmest antiquity. With our object ever in view we begin preparations to leave Leh for the borders of Tibet proper, the region of the wild yak, the wild ass and the fabulous unicorn of Tibet.

No jungle exists in the whole of Ladak; the few trees, mostly willow and poplar, are planted in villages for building purposes and fuel. The traveller will find no 'shady' tree under which to have his lunch between stages and, as he travels higher the gardens around villages will thin out and disappear.

The bird life then, for the most part, is terrestrial in habits and palaearctic in its zone of distribution. Thus the traveller meets, when he crosses the great Himalayas, the Magpie (*Pica pica bactriana*). Col. Meinertzhagen points out, in his paper on the Birds of Ladak in the *Ibis*, that the Magpie is essentially a bird of the wind-swept, open and almost treeless Ladak, in contradicton to Baker's habitat of this bird as being Kashmir, Kumaon and Gharwal.

Visitors to Kumaon and Gharwal will bear out the statement of Col. Meinertzhagen that the Magpie is not a bird of 'well-wooded' parts. Observations in Mesopotamia, Persia and Baluchistan, all countries that could do with a bit of vegetation, shew that the Magpie frequents the upland steppes.

The Tibetan Raven (*Corvus corax tibetanus*) is met with all over Ladak. His bell-like tones should be unmistakable to any visitor to the highlands of Ladak.

The Red-billed Chough (*Pyrrhocorax pyrrhocorax himalayanus*) extends over the greater part of Ladak, chiefly over 12,000 feet. It occurs on either side of the Great Himalayas as low as 6,000 feet in winter, up to 19,000 feet in summer.

The Yellow-billed Chough (*Pyrrhocorax graculus forsythi*) hardly distinguishable, on the wing, from the above bird appears to frequent the same localities—though not quite so common. Both these birds were breeding at Leh at 11,600 feet. Horned Larks (*Eremophila alpestris longirostris*) were common from 12,000 feet to the snow line.

The Great Tit (*Parus major kaschmiriensis*), common on either side of the Himalayas, extends for a considerable distance into Ladak, wherever there were trees.

Snow-Cocks (*Tetraogallus himalayensis himalayensis*) and the Chukor (*Alectoris graeca pallescens*) as distinguishable from *Alectoris graeca chukar*, a darker race, were common in the alpine regions of Ladak.

We left Leh on the 17th May for the valley of Chang-chen-Mo, 245 miles westward, which is the furthest point reached by any traveller, for beyond lies a wilderness of the coldest, bleakest and most desolate region conceivable.

We crossed over the Ladak range by the Chang-la pass, a regular corker in the way of passes—and one which touched the scale at 18,000 feet.

We had camped just below the pass at 15,700 feet the evening before the ascent and were fortunate in securing a fine series of Brandt's Mountain Finch (*Montifringilla brandti hæmatopyga*). They appear to be birds of the extreme altitudes and are met with usually on the fringe of the snows, upto 18,000 feet.

Before we crawl over the pass, I must dip my flag to Col. Meinertzhagen, who, with the tenacity with which leaders are made, got us over the pass when things looked their worst.

A relay of coolies were engaged to prevent any unnecessary delay on the pass, for what with the height and the thawing of the snow progress must be slow. There is an added danger after sunset on such passes. A caravan caught after sundown at 18,000 feet, would find it difficult to get through without losing a large part of its ' cattle ' and men. Such a catastrophe cannot be prevented in view of the sudden drop in the temperature after sunset.

When tackling a high pass, you must, like Felix, ' keep on walking '. It is preferable, to becoming a ruddy icicle, and helps the circulation. Your progress may resemble the gait of a beetle over the ridges and furrows of a ploughed field, but there is always the consoling thought that all passes have a summit.

As much as I would like to forget this one instance of the effects of high altitude, it may not come amiss to give first hand experience.

At altitudes over 16,000 feet, or at times 15,000 feet, it depends on one's physical condition, the traveller begins to feel the oppressiveness of the atmosphere. The mere act of turning over in bed is a respiratory exertion ; while ordinarily the respiration resembles the effects of a second hand bicycle pump.

A general listlessness is first observed, followed by a splitting headache, as if a smack has been taken at the skull with an axe—and the iron left in. Follows, if you have got it bad, a violent desire to be ' sick.'

I doubt if there is any preventive for these effects, though ' Crystallized Ginger ' may be recommended.

There is also a tendency to knock off ' food stuffs, '—particularly meat, though the craving for ' sweet stuffs ', such as sugar and jam, increases.

If on the other hand you are one of those who are blessed with the innards of a Tibetan—the symptoms will be noticeable in your camp. Your cook, if you haven't left him to die on one of the passes, usually finds he has a shocking grievance against the Shikari or *vice versa*. This being appeased, he develops a complication of disorders and a desire to peg out.

We crossed over the Changla pass and eleven miles beyond camped in a willow garden at 14,500 feet. Just beyond the pass we secured a Goosander (*Merganser castor*) which occurs sparingly on large sized rivers above 10,000 feet. Later on (July) we found the young in down on the Indus River below Leh.

The Brahminy Duck (*Casarca furruginea*) was first met at about 16,000 feet though they became commoner as we approached the more isolated watered valleys.

We now entered the higher uplands or the ' Changlung '—a name given to all that region north of the Ladak Range, and the floors of whose valleys rose from 14,500 feet to over 16,000 feet in the Chang-chen-mo. The mountainous chain that cuts across from northwest to southeast is a continuation of the mighty Kara Koram Range, which can be a real nuisance in its quiet way.

The pass over this range, the Marsimik-la Pass, topped the scale at 18,500 feet, and the ascent from 15,000 to the summit, in less than two miles, is a steady pull.

We had left Phobrung, which is the most easterly limit of ' civilization, ' in its broadest sense, on the 28th May and getting over the pass in fine style camped at 17,700 feet on the site of a Tartar camp.

Our transport consisted entirely of yaks, or to be more correct the hybrid known as ' zhoe. '

Wild yaks occur on the Chinese-Tibetan border at extremely high altitudes. Pocock mentions them as occurring in the Chang-chenmo valley at 20,000 feet in summer, descending to less snow covered country at 15,000 in winter. According to local intelligence the wild yak breeds between 20,000 and 22,000 feet, and the young are captured soon after birth.

The method of capture, and we give it for what it is worth, is for a party to rush down on the parent yak, with tom-toms and cat-calls thus driving it off. It is hard to believe anybody ' rushing ' about at these altitudes, burdened with tom-toms to say nothing of great demands on the respiratory organs without cat-calls ! The Tibetan is a wonderful fellow, and if, as some affirm, his pig-tail is used as an appendage by which Bhudda hauls up the ' failful '—to Nirvana, we should think that even without it, his sheer toughness ought to get him there.

At our camp at 17,700 feet it had snowed heavily all night and we had become anxious for our yakmen. But any anxiety was unnecessary. These hardy mountaineers had bunched together and allowed the snow to pile up over them and though not quite so comfortable and hygienic were decidedly warmer than we in our flapping tents !

The ' Zhoe ' will be found the best mode of transport over heavy snow and high passes. The novice will find he has not many lengthy intervals of rest once the animals get a move on. The older beasts appear to be ever thinking of a point ahead which they would rather have behind them.

On the 30th May we entered Chang-chen-mo valley. If there be any colder bleaker spot in this world, let me not know it.

When I look at my diary written at these altitudes, the general tone shares the pessimism of our cook. North, East or West was an unbroken panorama of bleakness and desolation, devoid of vegetation or any sign of human habitation.

Then, as if not satisfied with her effects, Nature let loose a piercing wind down the narrow valley, which very nearly froze the marrow in one's bones.

Our Transport of Hybrid Yaks.

Camp at Chang-chen-mo Valley, 14.500 ft
Breeding Ground of Brahminy Duck

However we seemed amply repaid for these discomfitures, from a natural history point of view of course.

The Tibetan Snow-Cock (*Tetraogallus tibetanus tibetanus,*) replaced the Himalayan species but were harder to obtain owing to the high altitudes (17,000 to 20,000 feet) which this bird frequents. In habits they do not differ from the other bird and appear not quite so shy.

The semblance of the track we had followed now disappeared entirely.

We observed a herd of Wild Asses that stood and took stock of our party, while we stumbled over the boulders. It may not do your temper much good to have a Wild Ass with his ears cocked, looking down on you as you worry your way along, but you soon get used to him and the ridiculous capers he cuts around the lagging transport.

The sight of a man seems to excite his curiosity immensely, and he will at times approach to within 25 yards for a thorough inspection of the biped.

I was able to observe a fine specimen at close quarters. After semaphoring with his ears he decided to take a walk round and then for no apparent reason, spun around and fled as if the furies were behind him. One could understand this behaviour if he had had a Tibetan to windward.

At the time I had put it down to my Kashmiri-cured posteen—but sportsmen have commented on this behaviour and its disturbing effects on other game—particularly *Ovis ammon* and the Tibetan Antelope.

The Tibetan Antelope, we find from ' Al Khanzir's ' narrative in one of Blackwood's numbers to be the ' original ' unicorn of Tibet. The horns of this animal are so placed that in profile they resemble a single horn.

The Tibetans most naturally do not admit this and ' Al Khanzir ' gives us the legend ' that should a unicorn espy a virgin he will instantly lay his head in her lap and look up into her eyes like a love sick swain '.

Such an incident has never occurred and though maidens are not plentiful in Tibet, they certainly do exist !

We shifted camp the next day, and ' discovered ' a delightful spot on the lee of a high cliff. A clear stream flowed past our camp, while all around were bushes and a grassy lawn.

The Brahminy Duck had its young here, all in down. The eggs are laid in a hole on the hillside and the young as soon as hatched are carried down to the water by the parent birds. A brood consists of six to eight eggs.

A common bird and one which turned out to be a new race, was the Ladak Twite. Col. Meinertzhagen has named this *Acanthis flavirostris ladacensis* and gives the following description :—

' Ladak birds are thick-billed as in *rufostrigata*, but differ from that race in fresh plumage in having the upper plumage not so red. In worn plumage Ladak birds are scarcely distinguishable from *rufostrigata*. They differ from *montanella* in having a richer and redder tone on the upper parts.

' A series of ten birds were obtained at Chimre (11,900 feet, May), Tankse (12,900 feet, May), Chanchenmo (14,800 feet, June), Pangkong Lake (13,900 feet, June), and Moulbekh (10,350 feet, August). Wings of five males 80-81 mm. and of five females 73-81 mm.

' The Ladak Twite is common wherever met. It is apparently confined to Eastern Ladak (my Moulbekh specimen being a solitary bird and probably a straggler from elsewhere). Observed at Zingral, Tankse, Pamzal, Pangkong Lake, Shushal, Puga, Tso Kar, Debring, and at Khardung. In summer they seldom come below 12,000 feet or over 15,000 feet.

' Nests with eggs were found at Tankse on May 21, on the Pangkong Lake on June 8, and on the Tso Kar on June 23, Clutches numbered three eggs in three cases and four eggs in three cases. Nests in low bushes (once 7 feet from the ground in a willow-tree), with thick lining of yak-hair.'

We left Chang-chen-mo Valley on June 4 and retracing our steps topped the Marsimik-la pass and descended to Phobrong in a single day. This may not sound anything like a feat, but the reader should bear in mind the rapid descent from 18,500 feet to 14,500 and the sudden change in the atmospheric conditions. If there in anything worse than a never ending track that zigzags skywards, it is a rapid descent of more than five miles over boulders and loose gravel.

We pitched our camp at Phobrong on a grassy lawn that sloped down to the Pang-Kong Lake whence it rose again to the great heights of the Ladak Range, now wreathed in fleecy clouds.

Evening finds contentment everywhere ; the yaks quietly chewing the cud, the men huddled together over their ' All steel ' pipes, and floating on the evening air the soothing sounds of the hubble-bubble from the kitchen tent. Forgotten are the grievances, a bond of friendship such as never could have existed in the higher altitudes, has brought together the cook, the ' pot walluper ', the shikari and one or two parasites, ' " The Burra Saheb ' is quite a descent stick, and not what we thought him at 17,000 feet ; the ' Chota Sahib ' uses some vile language but we know he doesn't mean it. Anyhow we are going back " '.

The cook firmly makes up his mind to give us a real change from the eternal ' estew '. Alas ! these resolutions vanish with the last pull off the hookah.

Our road now skirted the west shore of the Pangkong Salt Lake that lay between the outer ranges of the Ladak and Kara Koram Mountains. The Lake is the largest in these regions being nearly thirty miles in length and about five miles in breadth. Such is the intensity of the cold during winter in these parts, that villagers are able to drive herds of yaks and ponies across its frozen surface to the hill ranges opposite.

The Brown-headed Gull (*Larus brunneicephala*), a familiar bird in the Bombay Harbour and along the west coast of India, crosses over the Himalayas and breeds on such lakes. On our visit (June 8) the Gulls had attained their breeding plumage and by the size of their organs we concluded that the shingle banks were used as nesting sites.

About midway down the shore of the lake, we pitched camp in open bush-covered country and were fortunate in securing a series of the Tibetan Partridge, which have proved a new species and named by Col. Meinertzhagen as *Perdix hodgsoniæ caraganaæ.*

'Ladak birds,' he writes, 'are generally paler above, especially the chestnut nuchal collar. The dark brown markings on the upper parts of *P. h. hodgsoniæ* are replaced by chestnut markings in Ladak birds, though this is not invariable. In size they do not differ from *P. h. hodgsoniæ.*

Type in the Tring Museum: ♂, Shushal, 15,000 feet, Eastern Ladak, June 13, 1925.

Distributiæ. Shores of Pangkong Lake to Rupshu and Hanle. Is confined to the valleys where the Tibetan Gorse (*Cargan*) grows.'

(*To be continued*)

A LIST OF ORCHIDS, WITH SOME NEW SPECIES FROM THE HIGH WAVY MOUNTAIN (MADURA DISTRICT)

BY

E. Blatter, S.J., Ph.D., F.L.S.

(*With a plate*)

The following is a list of Orchids which were collected in the month of May 1917 by the late Prof. F. Hallberg and myself on the High Wavy Mountain at an altitude of 4,500 to 5,500 ft. The area examined measures about 12 square miles, covered with dense evergreen forest and some smaller patches of grassland, apparently forest-clearings.[1]

Before publishing this paper I sent my MS. and specimens to Mr. C. E. C. Fischer of the Kew Herbarium who is just engaged in writing the continuation of the unfinished work of the late Mr. Gamble's Flora of the Presidency of Madras. As the next issue of the Flora contains the Orchidaceæ and as Mr. Fischer knows the Madras Flora by many years' practical experience in that Presidency, I could scarcely find anybody better qualified to criticize my list. Though I cannot agree on every point with Mr. Fischer's views, I am greatly obliged to him for pointing out a number of mistakes I had made. He even discovered a new species amongst my material which I had failed to recognize as such.

1. Oberonia, Lindl.

1. **Oberonia Brunoniana**, Wight Ic. t. 1622.—Nos. 329, 330, ? 26551.

Distribution : W. Peninsula : Konkan, N. and S. Kanara, Nilgiris, Pulneys, mountains of Malabar and Travancore.

2. **Oberonia verticillata**, Wight Ic. t. 1626.—Nos. 26549, 26554.

Distribution : N. Kanara, Nilgiris, Pulneys, Travancore.

3. **Oberonia iridifolia**, Lindl. Gen. & Sp. Orchid. 15, var. **denticulata**, Hook. f. in Hooker Fl. Brit. Ind. v, 676.—*O. denticulata*, Wight Ic. t. 1625.—Nos. 331, 26550.

Distribution : Of variety : Nilgiris, Pulneys.

4. **Oberonia Lindleyana**, Wight Ic. t. 1624.—No. 26552.

Distribution : Nilgiris, Travancore Mts.

2. Liparis, Rich.

1. **Liparis viridiflora**, Lindl. Gen. & Sp. Orchid. 31.—No. 26546.

Distribution : Sikkim Himalaya, Upper Assam, Khasia Hills, Nilgiris.

2. **Liparis Wightiana**, Thwaites Enum. 295.—No. 26547.

Distribution : Pulneys, Travancore, Ceylon.

3. **Liparis sp.**—No. 26545.

Only one specimen in fruit.

3. Dendrobium, Swartz.

1. **Dendrobium nutans**, Lindl. Gen. & Sp. Orchid. 90 (including D. Jerdonianum, Wight Ic. t. 1644), var. **rubrolabris**, Blatter var. nov.—Sepala necnon petala alba, labium rubrum maculis purpureis.

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[1] See this Journal, vol. xxv (Sept. 1917), p. 290.

The lip has 3 very high, close, crisped lamellæ. Margin of midlobe very strongly crisped. Nos. 335, 25808.
Distribution of type: Coorg, Nilgiris, Ceylon.

2. **Dendrobium nanum**, Hook. f. Ic. Pl. t. 1583.—Nos. 26523, 25810.—Flowers pale pink, except lip which has a purple spot on each side.
Distribution: Malabar.

3. **Dendrobium sp.** near **nanum**, Hook. f.—Too young for proper identification.—No. 25811.

4. BULBOPHYLLUM, Thouars.

Bulbophyllum nilgherrense, Wight Ic. t. 1650.

The leaves are subacute, not retuse as shown in Wight's figure.—No. 340.
Distribution: Nilgiris, Malabar.

5. CIRRHOPETALUM, Lindl.

Cirrhopetalum Gamblei, Hook. f. in Hook. f. Fl. Brit. Ind. v, 778.—*C. Thomsoni*, Hook. f. l.c.—No. 332.
I intended to transfer this species to Bulbophyllum, following Smith: Bulbophyllum Thou., sect. Cirrhopetalum, in Bull. Jard. Bot. Buitenz., ser. 2, viii (Oct. 1912), 19–29. But Fischer tells me that Kränzlin, Schlechter and Rolfe have accepted Cirrhopetalum as a good genus, and he thinks that the unequal sepals make a good character to separate it from Bulbophyllum.
Distribution: Nilgris, Pulneys, Bababoodan Hills.

6. CHRYSOGLOSSUM, Blume.

1. **Chrysoglossum Hallbergii**, Blatter, sp. nov. (*Orchidaceæ—Epidendreæ—Dendrobieæ*). Similis Chrysoglosso maculato, Hook.f. sed recedit ab eo habitu epiphytico, mento saccato, disco labii 3 lamellis prædito, bracteis multo longioribus.
Epiphytic. Pseudobulb 1-leaved, leaf with 5 large and very numerous close finer veins. Scape lateral, about 12-flowered, with 3 sheaths. Bracts longer than pedicel and ovary. Flowers pedicellate. Perianth-segments all 9 mm. long. Sepals and petals obovate-lanceolate to lanceolate-acute, the latter broader, all 3-nerved. The lateral sepals united to the upper half of the spur of the lip, forming a small saccate mentum, below which the proper spur may be distinguished, which is subcylindrical, slightly incurved and not quite 1 mm. long. Lip clawed, 3-lobed, midlobe much longer than the side-lobes, suborbicular, obtuse, with a very broad claw, base of claw minutely auricled, side-lobes subrectangular, obtuse. Disk with 3 very distinct lamellæ. Column slender, bent forward, winged in front, the wings becoming broader and thicker downwards, forming a long foot, each wing having a large auricle about half-way down. Anthers small, terminal, opercular, with a frontal cusp, 2-celled, cells distinct, hemispherical. Pollinia 2, free, subglobose, waxy.—No. 26488.
2. **Chrysoglossum sp.** Probably a form of *C. maculatum* Hook.f.—Epiphytic, not in flower. Found together with the new species, but the finer nerves are not so close, and the leaves are in tufts, not solitary on the pseudobulb.—No. 26487.
3. ? **Chrysoglossum sp.**—No. 26487.

7. ERIA, Lindl.

1. **Eria braccata**, Lindl. Journ. Linn. Soc. iii, 46.—*E. reticosa*, Wight Ic. t. 1637.—No. 338.
Distribution: W. Ghats, Konkan, Nilgiris, Ceylon.

2. **Eria pauciflora**, Wight Ic.t. 1639.—No. 337.
Distribution: Nilgiris.

3. **Eria nana**, A. Rich. ?, but too incomplete for certainty.—No. 25809.

4. **Eria pseudoclavicaulis**, Blatter, sp. nov. (*Orchidaceæ—Epidendreæ—Erieæ, Sect. Hymeneriæ*). Distinguitur ab Eria clavicauli, Wall. foliis longioribus

non acuminatis, internodiis longioribus, racemo unifloro, bracteis oblongis acutis haud nervosis, sepalo dorsali elliptico-oblongo obtuso, petalis subobtusis.

Epiphytic. Stems tufted, clavate, terete, with numerous longitudinal fissures above, 20 cm. long; last internode 7 by 1·5 cm., swollen in the middle, slightly oblique; next internode 7 cm., thickest on top, the following 5 by ½ cm., cylindrical. Sheaths 0. Leaves 3, 16–17 by 4–4·5 cm., oblong-lanceolate, acute, coriaceous; nerves numerous, stronger ones regularly distributed, between which there are a number of very fine close ones. Peduncle opposite the middle leaf, 22 mm. long, terete, pedicel solitary, strongly ribbed upwards, both thinly brown-pubescent; at base of peduncle a small sheath; at junction of peduncle and pedicel two large bracts which are olive coloured, oblong, acute, half-amplexicaul, glabrous, hardly nerved, one lower than the other; opposite the upper is a small upcurved awn, possibly a reduced second pedicel. Flowers faintly fragrant, glabrous, mainly white, mentum tinged with pink. Dorsal sepal 15 by 6 mm., elliptic-oblong, obtuse; lateral sepals very broad at base, 15 mm. long, triangular, falcate, subacute, reflexed, mentum 8 mm. long. Petals falcately oblong, 14 by 5 mm., subobtuse. Lip sessile at the base of the column, incumbent, much shorter than the lateral sepals, broadly obovate, subequally 3-lobed with the margins light-purplish fading inwards, all lobes slighly crisped, lateral lobes bent inwards, midlobe minutely white-puberulous. Disk with a white pubescent ridge, 2 mm. broad in the lower half, which portion has in front 2 small lateral calli, the upper half much narrower, yellowish, hardly reaching the subacute tip of the midlobe. Column white, bent nearly at a right angle to the axis of the flower below the stigma and produced into a long foot forming the broad mentum together with the lateral sepals, foot broadest at the bend, marked further out with a few faint buff spots. Stigmatic cavity broad, below the horizontal rostellum. Anther opercular, embraced by the flaps of the column, 2-celled, cells approximate at base behind. Pollinia 3 in each cell, connected by their bases, 2 much larger than the third, compressd, pyriform, pale cream-coloured.

Described from one specimen which was brought to Bombay where it flowered in the beginning of September 1917.—No. 554, kept in formalin at St. Xavier's College, Bombay.

8. JOSEPHIA, Wight

Josephia lanceolata, Wight Ic. t. 1742.—No. 333.

Distribution: Central Provinces, W. Ghats from the Konkan to Travancore, Ceylon.

9. CŒLOGYNE, Lindl.

Coelogyne nervosa, A. Rich. in Ann. Sc. Nat. ser. 2, xv, 16.—C. corrugata, Wight.

Side lobes of lip much veined inside with orange-yellow. The 3 raised ridges of the disk yellow in front; rest of corolla white. Pollinia pale yellow. Wings of column orange.

Our specimen flowered in Bombay in September 1917.—No. 339.

Distribution: Nilgiris, Pulneys, Travancore hills.

10. AERIDES, Lour.

Aerides cylindricum, Lindl. in Wall. Cat. 7317.—Nos. 122, 25801, 25806, 25807. Sepals and petals of No. 122 white, lip pale pink.—Not common.

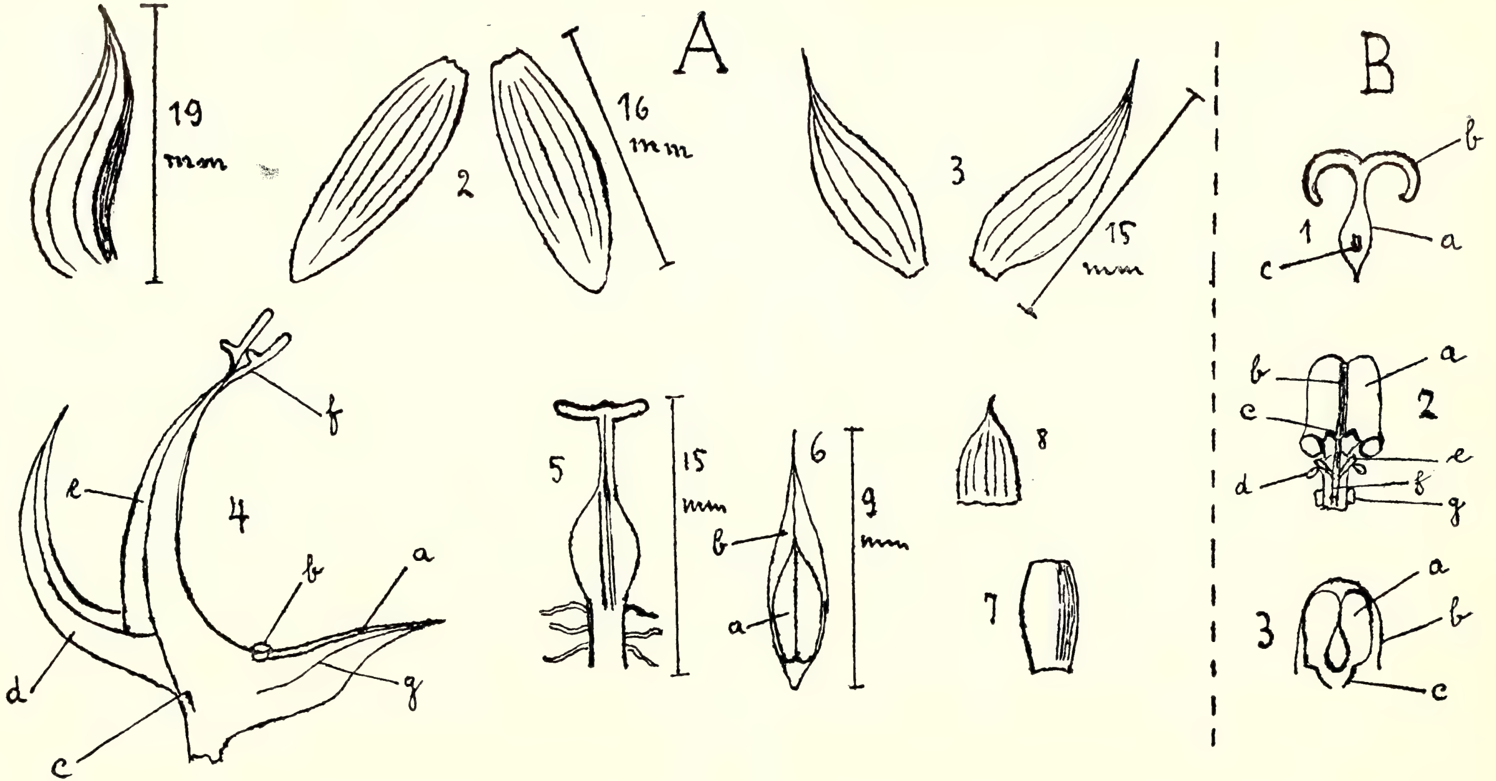
Distribution: From the Coorg Hills to Travancore.

11. SACCOLABIUM, Bl.

1. **Saccolabium pulchellum**, C. E. C. Fischer.—*S. nilagiricum*, Hook. f. in Hook. Fl. Brit. Ind. vi, 60.—*Vanda pulchella*, Wight Ic. t. 1671.—No. 342.

Distribution: Nilgiris.

2. **Saccolabium filiforme**, Lindl. in Journ. Linn. Soc. iii, 36. The colour of the flower seems to vary a good deal. In Wight's plant they are rose-coloured, in


A
19 mm
2
16 mm
3
15 mm
4
a
b
c
d
e
f
g
5
15 mm
6
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2
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c
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A. *Odontochilus rotundifolius*, Blatter, sp. nov. 1. Dorsal sepal. 2. Lateral sepal. 3. Petals. 4. *a*. Process of column. *b*. Calli. *c*. Base of anther. *d*. Connective of anther. *e*. Clinandrium. *f*. Rostellar arms. *g*. Lateral veins of process of column. 5. Lip. 6. Anther. *a*. Pollinia. *b*. Connective. 7. Ovary. 8. Bract.

B. *Disperis neilgherrensis*, Wight. 1. *a*. Midlobe. *b*. Side-lobes. *c*. Spur. 2. *a*. Rostellum. *b*. Stout midnerve of rostellum. *c*. Stigma *d*. Process of rostellum with gland. *e*. Lateral lobes of lip. *f*. Claw of lip. *g*. Papillose appendage. 3. Anther: *a*. Cell. *b*. Connective. *c*. Process of cell.

Ceylon plants orange with red stripes. Our flowers are bright brick-red, lip orange, midrib of petals very prominent, ending in a point short of margin, lateral veins very obscure, close to midrib.

Hook. f. (Fl. Brit. Ind. vi, 54) mentions expressly that the sac of Saccolabium is ' without a large scale or callus within under the column ' except in S. *longifolium*. There is one, however, in our specimens as well as in Fyson's t. 250 illustrating *S. filiforme*, Lindl. See also Wight Ic. 1685, text.

Fischer who examined some flowers of the same specimen could not find a trace of a callus. I presume that it is sometimes present and sometimes not. In any case Hooker's general statement about the presence of the callus will have to be slightly modified. No. 189.

3. **Saccolabium gracile,** Lindl. Gen. & Sp. Orchid. 225.—No. 26531.

Distribution : Ceylon.

12. CLEISOSTOMA, Bl.

Cleisostoma tenerum, Hook. f. in Hook. f. Fl. Brit. Ind., vi, 73.

Sepals and petals green with purplish longitudinal markings. Lip white, side-lobes yellowish with purple markings. The whole flower, except the midlobe, sometimes assuming an orange hue in the same plant. Leaves 7-nerved. Rostellum 2-lobed at base, each lobe with a horizontal linear appendage ; in the space thus formed rests the gland.—Nos. 30, 25805, 25803, 25804.

Distribution : Nilgiris, Ceylon.

13. ANAECTOCHILUS, Bl.

Anæctochilus elatior, Lindl. in Journ. Linn. Soc. i, 178.—No. 834.

Distribution : Nilgiris.

14. ODONTOCHILUS, Bl.

Odontochilus rotundifolius, Blatter, sp. nov. (*Orchidaceæ—Neottiæ—Spirantheæ*) Caulis terrestris nanus procumbens ; folia pauca, parva, rotundo-mucronata. Flores albi ; sepalum dorsale necnon petala apice brunnea. Sepala erecta, dorsale quidem 2 cm. attingens, 5-nervosum, lateralia autem 16 mm. longa, oblonga, 5-nervosa. Petala 15 mm. longa oblongo-acuminata subfalcata, 3-nervosa. Labium 14 mm. longum apice 2 lobis elongatis fere horizontalibus ornatum. Columna brevis appendice frontali praedita. Rostelli brachia longa, unoquoque brachio lobulo unico ventrali munito. Forma foliorum necnon sepala 5-nervosa hanc speciem a ceteris speciebus affinibus distinguunt.

Terrestrial. Stem nodose, procumbent, creeping below, bulbous-based-hairy, 15 cm. high. Leaves few, almost orbicular, mucronate, the largest seen 2 cm. diam., glabrous, midrib distinct on lower surface, stalk about as long as blade, bulbous-based-hairy, amplexicaul. Flower terminal, solitary, nodding ; bract broadly ovate-acuminate, as long as the ovary. Sepals erect (not spreading), green at base, rest whitish ; dorsal sepal 19 mm. long, concave-hooded, 5-nerved, tip reflexed, brown ; lateral sepals 16 mm. long, oblong, subobtuse, 5-nerved, connate at the base and concealing the minute spur of the lip. Petals 15 mm. long, oblong-acuminate, subfalcate, 3-nerved, white, tips brown. Lip white, adnate to the base of the column, base with a minute subsaccate spur ; claw broad, entire, 4 mm. long, with a few long hairs, then the lip is bulging out into 2 rounded lobes for a distance of 5 mm. and again contracting, after that narrow-linear for 5 mm. with 2 short elongate obtuse lobes spreading almost horizontally at the apex. Column short, white, frontal appendage of column cup-shaped, lanceolate-acuminate when seen from the side, lying in the folded claw of the lip ; calli small. Rostellar arms long, slender, each with a minute lobe on the ventral side. Anther lanceolate-acuminate, curved ; pollinia broadly lanceolate in outline ; caudicles long, slender. Ovary 5 by 2 mm., slighly broader upwards, densely pubescent.—Plate 1, A.

Described from one specimen which we found in damp evergreen forest. Seems to be very rare —No. 25802.

15. SPIRANTHES, Rich.

1. **Spiranthes australis**, Lindl. in Bot. Reg. t. 823.

Fischer thinks this must be a sport of *S. australis*, Lindl. = *S. sinensis*, Ames, Orchid. ii (1908), 53.

The flowers are polymorphous. The top flower is larger, sepals and petals obtuse, sepals minutely serrulate. Rostellum mucronate at tip. Rostellum of lower flowers smaller, minutely bifid at apex.—Flowers white, tinged with pink.

Found near top of plateau.—No. 26528.

Distribution : Throughout India, Afghanistan, N. Asia, China, Java, Australia, N. Zealand.

16. ZEUXINE, Lindl.

1. **Zeuxine longilabris**, Benth. in Gen. Pl. iii, 600.

Differs from other known specimens in the colour of the flower : Sepals olive with white margins. Lateral petals and lip white with olive base. Column orange. Bract pinkish. Ovary olive with 3 lighter stripes. No. 26530.

2. **Zeuxine Blatteri**, C. E. C. Fischer in Kew Bull, 1927.

Sepals greenish with pale tips. Petals pale-pink. Sac orange. Limb white.

Found in damp evergreen forest.—No. 343.

17. PERISTYLUS, Bl.

1. **Perristylus stenostachyus**, Krzl.—*Habenaria stenostachya*, Benth. Fl. Hongk. 362.—*Habenaria peristyloides*, Wight Ic. t. 1702.—No. 26507.

Distribution : Sikkim Himalaya, Khasia Hills, Tenasserim, Deccan Peninsula, from the Konkan southward, China.

18. SATYRIUM, Swartz.

1. **Satyrium nepalense**, Don Prodr. 26.

We found only one dry specimen in bare patches of the hill-top.—No. 344.

Distribution : Temperate Himalaya, from Kashmir to Sikkim, Khasia Hills, Deccan Peninsula, from the Konkan to Travancore, Ceylon.

19. DISPERIS, Swartz.

1. **Disperis neilgherrensis**, Wight Ic. t. 1719.—*D. zeylanica*, Trin. Cat. Pl. Ceyl. 91.

As many points in the morphology of this species are not, or only partially, known, I give a full description of our specimen :

A small plant, 7–11 cm. high, all glabrous. Tuber entire, 2 by 1 cm. Stem rather stout, fleshy. Leaf solitary, very rarely 2, situated about ⅔ up the stem, broadly ovate, acute, sessile, cordate, subentire, 5–7-nerved, amplexicaul. Flowers few, subsessile, each with a leaf-like bract. Pedicel and ovary up to 15 mm. long. Dorsal sepal narowly lanceolate, 3-nerved, rather obtuse, forming together with the petals a concave hood 1 cm. long and as broad, only glued together, not united. Lateral sepals spreading, broadly falcately ovate, united for about 3 mm., 10 by 5 mm., subacute, with 5 nerves from the base 1, the central one more prominent, each with a small saccate spur about 3 mm. from the base. Petals broadly semilunate, subobtuse, with several anastomosing nerves and an oblique band marking the position of the dorsal sepal, margin minutely papillose, slightly waved, Sepals and petals white at base, rest greenish, veins purple. Lip : midlobe 3-lobed. Claw erect, confluent with column. Midlobe pendulous, resting on the claw, subacute, in the centre with a short, laterally compressed, obtuse, oblong spur which is slightly tomentose. The lip is folded along the side-lobes which, therefore, are channelled below, they are strongly curved downwards and papillose and yellow-tomentose above, united with the pendulous portion for some distance ; the lower part of midlobe (before meeting its side-lobes) lies along the large rostellum, but is not united with it; the side-lobes surmount the column. Lateral lobes of lip very short, spreading. Column resting on and united with claw of lip, horizontal and having 2 papillose appendages at the base. Stigma consisting of 2 small fleshy processes just above the place where the lateral lobes of the lip are situated. Anther posticous, erect, attached below to the conniving column and claw ; cells close together above, but distinct, with a short process below, appear to be open from the beginning. In front of anther and enclosing its margins lies the large rostellum ; it is emarginate at the tip, withering downwards with recurved margins and has at the base 2 hyaline flat appendages along which the caudicles of the pollinia rest and with a large flat deltoid exposed gland at its apex. Caudicles not twisted, bright yellow ; pollen-grains olive-green, 2-seriate, secund on the twisted axis, cuneiform, compressed. Ovary up to 14 mm. long, 6-ribbed, slightly twisted.—Plate 1. B.

Found among damp leaves in evergreen forest, not common. No. 345.

All the specimens mentioned in this paper are at Kew.

AN ACCOUNT OF THE PEARL FISHERIES OF TUTICORIN MARCH AND APRIL 1927

BY

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(*With four plates*)

This pearl fishery was held, under the directorship of Dr. B. Sundara Raj, M.A., Ph.D., Director of Fisheries to the Government of Madras, in the months of March and April, 1927. The Government of Bombay had permitted me to go to Tuticorin to observe and study the different processes involved in carrying out a pearl fishery.

There have been many fisheries in previous years but never before was a fishery held on such a grand scale as the present one as regards the extent and the excellent organization of the camp and magnificent operations at sea.

The story of the pearl fishery will be best understood if it is described under three different aspects, the first of them dealing in outline with the life history and the habits of the pearl oyster, the second with the formation of pearls and the last describing in minute details the different operations of the fishery.

I. **Pearl Oyster**.—The celebrated pearl oyster of Tuticorin, known as *Margaritifera vulgaris*, belongs to the family of *Aviculidæ* having close affinities with Scallops (*Pecten*) and Mussels. It differs from Edible oysters in the possession of bundles of tough threads (byssus) by means of which it anchors itself to the substratum.

Some of the general characters of the family are as follows :—

'The shell is usually inequivalve ; the dorsal margin straight, often very long and forming anterior and posterior wings or ears ; the lateral teeth of the hinge line are much prolonged and may be inconspicuous ; the mantle lobes are not fused ; siphons are absent ; the foot is moderately long, tongue-shaped with a well developed byssus gland ; the posterior adductor muscle is very large and nearly central, the anterior adductor muscle absent.'

The internal characters need not be mentioned here.

Life History and Habits.—The Pearl oyster is unisexual and remains so till the end of its life unlike what has been observed in the edible oyster which changes its sex after each spawning period. It becomes sexually mature within the first two years of its life and spawns twice a year in the beginning of the South-west and North-east Monsoons. Its fecundity is enormous. Eggs are extruded direct from the oviducts by means of the suprabranchial passage to the sea and are fertilized in the open sea by spermatozoa emitted by ripe males.

Eggs undergoing development after fertilization become swimming embryos within a very short time. The latter pass through different stages such as trochosphere, veliger, etc., and are transformed within a week into spats, i.e., very tiny oysters with symmetrical shells and delicate byssus threads. Before the spat formation, the larvae or embryos are at the mercy of ocean drifts and currents which carry them in all directions. As soon as the spat is formed, it gets itself attached by means of the delicate byssus threads to any floating or rooted algæ. It seeks the shady under side of the branches and sooner or later drops off and sinks to the bottom being dislodged by shaking or by the disintegration of the floating weed. Once it is on the bottom it begins to grow in size, all the time being anchored firmly to the substratum by means of those byssus threads.

Though the anchorage is firm, the Pearl oyster is by no means a sedentary and helpless animal. It creeps slowly along the surface by means of its long and tongue-shaped foot when the byssus threads are damaged or uprooted. This oyster has got the power of forming over and over again byssus threads which are secreted by a certain gland situated in the foot.

The shell of this oyster continues to grow in length till the third or the fourth year of its life. After this period it thickens greatly by the deposit of nacreous material in its interior and especially in the neighbourhood of the hinge at the dorsal edge. This is the time of rapid pearl formation. The oyster tissues are then in the condition which lends to the secretion and deposition of limy material either externally by addition to the thickness of the shell or internally as successive coats deposited on any particle, such as a dead parasite, sand grain, diatom, a fragment of nacre, ova or excreta, which has given rise to the necessary stimulation. At about this time or a little later the oyster becomes fishable when it measures about 4 by 3 inches. If it is not fished at the proper time (which is a mysterious period) the oyster has got a tendency to disappear. Causes of its disappearance are not yet discovered.

Longevity of the oyster is not definitely known but it appears that it does not live beyond six or seven years.

Banks or Paars.—The grounds on which these oysters are found aggregated close together are known as Pearl oyster banks or paars (meaning rock or any form of hard bottom in distinction to 'manul' which indicates loose or soft sand). "The Pearl bank plateau is bounded for the most part by 10 or 12 fathom line. Outside the paars, the ground shelves away rapidly to 20 to 30 fathoms which marks the top of the steep slope down to the mud-floored abyss forming the central portion of the Gulf of Manaar. Along the line of this slope, soundings in some places jump in short distances to anything between 100 and 1,000 fathoms. Within 10 or 12 fathom line, on the other hand, the ground is for the most part very level." At Tuticorin a distance of 10 to 12 miles is run from shore before a depth of 10 fathoms is reached.

The surface of these plateaus is either sandy diversified here and there by outcrops of so-called rocks generally in the form of flat or slightly inclined ledges or low terraces, or entirely rocky with a mount of sand in crevices. The rock in the latter case may sometime be covered by a thin layer of sand which shifts from time to time with the currents.

The rock of the plateau may be grit stone formed of yellow tinted quartz sand cemented by carbonate of lime or it may be largely dead, worn and altered coral or it may be a shelly mass, an agglomerate of dead valves of pearl oysters and other molluscs.

'A certain amount of sandy bottom interspersed with harder tracts and with plenty of cultch, natural or artificial i.e., fragments of dead coral and of calcretes, broken shells lying on the sand is probably the most favourable ground. The cultch gives foothold for new broods of oysters and at the same time helps to stiffen the shifting sand and prevents in some degree the wash out and turnover of the surface which is caused by a heavy swell.'

These banks abound in rich flora and fauna besides the pearl oysters. The microscopic spores and embryos of these plants and animals form the substantial food of these oysters.

Enemies of the Pearl Oyster.—The Pearl oyster is a very delicate animal. Though it is found in shallow waters up to 10 to 12 fathom line within as many miles from the shore, the sea water in which it is found must be clean i.e., free from any sandy suspensions and also free from any dilutations of fresh water from the land. These two factors alone will kill the oyster.

Besides the above there are other causes of death of these oysters ;

(1) *Shifting of Sand.*—This shifting which buries oysters and kills them is caused by strong currents set up by the South-west monsoons and other storms.

(2) *Predacious Fish.*—Sharks, Rays and File fishes devour these oysters. Though enemies, they form a necessary link in formation of pearls in oysters. This connection will be explained later on.

(3) *Boring Animals.*—Boring sponges and boring molluscs, bore holes into the shells. The former allow parasites and sand grains to enter through the holes, into the soft body of the oyster and thus kill it indirectly, while the latter suck the soft parts through these holes and swallow them.

(4) Miscellaneous causes such as overcrowding, over-fishing and epidemic due to Protozoan or other parasites.

II. **Pearls.**—In India there is a popular belief that pearls are formed by drops of rain falling at a particular period known as *Swati*. At this time it is supposed that pearl oysters come up to the surface of the sea water, open their shells and wait for the drops. As soon as these drops have fallen into them, the shells are closed and the animals go to the bottom. These drops become afterwards pearls. Such and similar beliefs are still held by different communities all over the world.

Scientifically speaking, there are three important methods in the formation of pearls ;

(1) Grains of sand, minute fragments of nacre, etc.
(2) Pathological secretions.
(3) Cestode embryos.

any one of the above entering into the body of the oyster causes irritation and then stimulation to deposit pearly nacre around the source of irritation. This nacre is deposited by an epithelial layer derived from the ectoderm (skin).

Almost all the fine pearls found free in the body are formed by deposition of nacre around the cestode embryos which find entrance into the oyster. It will be very interesting reading if a complete life cycle of this pearl-stimulating cestode is described here.

' The adult worm (*Tetrarhynchus unionifactor*) from the body of a Shark or Ray sets free its numerous young embryos into the sea. Such free swimming embryos gain entrance with food currents into the body of the oyster. They are found in the mantle, in the gills, in the liver and also in the connective tissue of the body wall in an encysted or encapsuled condition. If these infested oysters are eaten by File fish (Balistes) Sharks or Rays, the cestode larvæ are transferred to the body of the new host where they begin to grow. These cestodes are then in a recognizable stage of *Tetrarhynchus* but they are not yet adult nor have they reproductive organs. It is not yet definitely determined whether these immature cestode forms reach their maturity in the same fish or in another new host, i.e., Shark or Ray which preys on the File fish.'

' In those oysters which do not become the prey of the File fish, the cestode larvae have no chance of completing their life cycle. They die and become encapsuled in the layers of pearl nacre deposited by the living tissues of the oyster upon the source of irritation caused by the cestode embryo which ultimately becomes the centre of a brilliant and costly pearl.'

Thus it will be seen from the above that the predaceous fish form a necessary link in formation of pearls. ' No rays, no pearls ; abundance of rays no oysters, as the latter are destroyed by the former. But Nature has somehow restored the balance between the oysters and the predaceous fish.'[1]

Different views as to pearl-formation can be best summed up in Prof. Herdman's words:—

(1) Majority of pearly excrescences on the interior of the shell are due to the irritation caused by boring animals. In exceptional cases a free pearl may be formed in this way. There is a device by means of which these blisters or excrescences are cut and filed into pearls of very low order. These pearls are then known as Vottu or Blister pearl.

(2) Minute grains of sand or inorganic particles form the nucleus of pearls under exceptional circumstances. When the shell is damaged, these sand grains get into the interior and supply the irritation that gives rise to pearl formation. These are known as Ampullar pearls.

(3) Many pearls are found in the muscles close to surface. These are formed around minute calcareous concretions, the Calcosperules, which are produced in the tissues and form centres of irritation. These are known as Muscle pearls.

(4) Most of the fine pearls found free in the body contain the remains of the cestode parasites (embryos). They supply the requisite irritation for pearl formation. These are known as Cyst pearls.

Valuation of Pearls.—Valuation of pearls is a very complicated affair. The principle underlying this valuation is to pass pearls through different sieves. Each sieve is round about 6 to 8 inches in diameter and 2 to 3 inches high with sized holes in the bottom. The size of the holes in each basket (sieve) is different. The pearls that do not pass through the holes of any particular sieve have a different value and different name. In this manner different pearls are valued and classified.

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[1] *Report of the Ceylon Pearl Fishery, 1925–26.*

1. Pearl Bazaar guarded by Police.

2. A Corner of the General Bazaar, Pearl Fishery Camp.

3. Divers' Encampment.

4. Divers at Work.

Names of pearls depending on valuation, size, shape and lustre are different in different parts of India. If mentioned here, it will cause more confusion and will serve little or no purpose at all in this narration.[1]

III. **Pearl Fishery.**—A pearl fishery involves many operations, some at sea and others on land, but long before it actually begins, the banks or paars have been surveyed many times in order to investigate spatfalls as well as numbers of fishable oysters. If the survey results as to the quantity of fishable oysters, and if the valuation reports of pearls contained therein are satisfactory, it is then and then only decided to hold a fishery. In order to make it known to all concerned, it is thoroughly advertised in Burma, Ceylon and other parts of India and the world through various newspapers, so that rich pearl merchants will be attracted to the place. In the meanwhile divers are being recruited, fishing boats are being brought to the place and the camp is being constructed on the spot where the fishery will be held.

Fishery Camp at Silavathurai and its Administration.—The site of this pearl fishery camp known as Silavathurai lies at a distance of nearly two and half miles to the north of the town of Tuticorin. 'It is the time-honoured spot where fisheries from ancient Hindu and Portuguese days have been held.'[2]

The camp covers an area of more than 100 acres. The front i.e. the eastern portion of the camp extends up to the open beach, while the rear (western) portion lies amidst Palmyra trees. On the south side it is bounded by a series of small lagoons which separate the town from the camp, while to the north lies a piece of uncultivated land full of thorny bushes and cactus, a small back-water channel and a salt factory, a mile or so away from the camp.

On the beach are built huts or quarters for officers, visitors and the staff. A little towards the south, but facing the beach, are constructed offices including an auction hall in front of the old beacon. In the same line parallel with the beach but far away towards the south is built a Kottu (store) for Government shells, and still further away on the beach itself for nearly a mile are located series of huts known as Thotties for rotting oysters.

Just behind the offices is reserved an area for retail selling and cutting open oysters by retail buyers. The area known as Sales Ground is fenced with wire all round except at two opposite ends which are kept open for admission into and exit from it.

The pearl bazaar extends on both sides of the road which runs east to west from the Sales Ground. This bazaar consists of pearl shops opened by pearl merchants coming here from different places but mostly from Bombay. These shops are rented out to them and Government receive a good income out of it.

A road which runs at right angles to the west end of the pearl bazaar accommodates shops of green grocers and eating houses for various kinds of people who frequent the camp. There are also some cloth shops. These shops are also rented out.

There are two or three roads running east to west at right angles to the mid portion of the general bazaar on either side of which are built huts for divers, different sects occupying different areas. These huts are given free to these divers.

Behind all the above roads but a long way off towards the west are sunk eight tube wells which supply water to the whole camp. They are worked with a hand pump. Water is supplied in a bullock cart to the officers and the staff, but other people have to take water from the pump which is worked by Government coolies. A guard is placed at each tube well to see that no bathing, washing or polluting the water in any way is done. The water arrangements are in charge of a mechanic lent for the purpose by the Industrial Department of Madras.

In the north-west corner, but away from the tube wells and also from the camp, there are bathing places for divers and others. A contractor who is in charge of these places collects a small fee for every bath. One can see a crowd of bathers every evening when divers have returned ashore all tired and wanting a cold bath to refresh themselves.

The whole camp is well guarded by constables who are in charge of one Inspector of Police and his two assistants. Its health is also well looked after by Medical and Sanitary authorities. There is a small hospital with an outdoor dispensary attached to it.

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[1] The above account of the pearl oyster and the formation of pearls is mainly based on Prof. Herdman's Reports to the Government of Ceylon.

[2] *Report of the Pearl Fishery, Tuticorin, Madras, 1926-27.*

One Additional Superintendent who is recruited from the Revenue Department looks after administration of the camp. He goes round the whole camp twice a day morning and evening, supervising the general comfort.

The lighting is done by the department itself and it is in charge of the above officer. The roads are well lit with Kitson lights.

Peaceful and harmonious working of the whole camp reflects a great capacity for organization and tact on the part of the Director of Fisheries.

Operations up to Diving.—Nearly one thousand skin divers took part in this fishery. There were Christian divers, mostly local i.e., from Tuticorin, there were Mohamadan divers from a place called Kilakarai, now famous for efficient divers, and there was also in addition to the above, a sprinkling of Arab divers once famous for diving. These divers not possessing a boat of their own, had to hire a fishing boat to take them out to the pearl banks and bring them back ashore after the day's work. Every boat taking part in a fishery has to obtain first a pass from the Customs Department which (pass) is handed back to the same authorities after the fishery is over. These divers have also to hire men for lowering them into the sea and haul them and their baskets up during the period of diving. These men, known as mandacks, are really the crew of the boats doing additional work and earning extra money.

Nearly seventy-eight boats were engaged in this fishery.

Before the actual start from the shore which was at about four o'clock in the morning, the tindal of every fishing boat had to obtain a fresh permit every night from the Beach Master as to the number of divers and mandacks his boat was carrying to the place of fishing. The permits were made in different colours and boats were accordingly divided into several groups, those of each group having a permit of the same colour. The purpose of this device will be clearly understood when a certain operation i.e., the division of oysters at sea, is described later on.

Every night in the camp a gun was fired at 11 p.m., a second gun at 3 a.m. and the last at 4 a.m. when boats and divers were supposed to be ready for departure from the shore. When everything was ready, the boats weighed anchor and set sail for the place of fishing. If the winds were unfavourable, these boats were generally towed either by the Government Trawler *Lady Goschen* or a hired tug, for a distance of 10 or 12 miles to the places on the pearl banks already marked out for fishing by the Superintendent in charge of the Pearl Banks. Once the fishing boats arrived on the spot, they cast their anchors and the divers got ready for diving. By this time there was sufficient light for diving purposes.

OPERATIONS FROM DIVING TO RETURNING OF DIVERS ASHORE

Complement of each boat.—In each boat there were two classes of men directly concerned with diving, one of them being divers 10 to 12 in number and the other, as many mandacks. Besides the above, there was the tindal of the boat with six to twelve men as the crew according to the size of the boat. Sometimes the mandacks themselves constitute in number the crew.

Methods of Diving.—There appeared to be no standardized method of diving. ' The Arab divers had poles projecting over the sides of their boats by means of which they hoisted themselves out of the water by an acrobatic movement. They usually used horn clips on the nose and it was their custom to come to the surface hanging on to the rope with the left hand and not letting it go in mid water until they reached the surface.

' Most of the Tamil boats have temporary outriggers fitted to the sides of the boats from which the divers are suspended. The Tamil divers do not wear horn clips on their nose, but instead the nose is held between the thumb and the fore finger during the rapid descent to the bottom. They let go the rope in mid water after they have received an initial pull sufficient to bring them to the surface. The disadvantage of this method is that these divers reach the surface some yards away from their boats and also spend more energy in coming up.

' With rare exceptions both kinds of divers go down feet first with their feet resting on the stone sinker. A few of them are seen to hold the sinker near the chest and dive in head first. '[1]

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[1] *Report of the Ceylon Pearl Fishery, 1925–26.*

5. Division of Spoils at Sea.

6. Bags of Oysters.
(Each bag contains 500 oysters.)

7. The Return of the Divers.

8. Washing the Pearl Oysters.

Every diver carries two ropes with him to the bottom one of them attached to the stone sinker and the other to the basket in which oysters picked from the bottom are raised to the surface.

Both these ropes are hauled by the mandack. As soon as the diver reaches the bottom, the stone sinker is let loose which is immediately hauled up to the surface. In the meanwhile the diver is feverishly busy in picking up the oysters or whatever comes to his hands and collecting them in the basket. He pulls at the basket rope whenever he wishes to rise to the surface for fresh air. Immediately the mandack begins to haul up the basket with the diver and within a few seconds both of them are brought to the surface.

After some rest the diver commences his work again.

Diving was done till a signal was given in the shape of firing of a gun or a shrill siren from a trawler when diving from all the boats had to cease at once. This took place at about 1 p.m.

In the meanwhile the Superintendent of the Pearl Banks was very busy in supervising the fishing boats. If the latter had strayed out of their places, they were towed back to their former or sometimes to new places. It is an advantage that all boats should work together on a particular spot. He also saw to it that diving ceased at once after the signal was given and that there was no illegal cutting of oysters before the division was made.

Division of Oysters at Sea.—As soon as diving ceased, boats began to approach, one by one, the Government schooners which were anchored on the fishing ground. Each side of the deck of these schooners flew a flag of a particular colour. Only those fishing boats approached that particular side which had permits of the colour of the flag flying on that side. This device saves a lot of worry and labour and provides a check on the boats and the divers.

On each side of the deck were placed two officers one for making divisions of the oysters brought by the divers and the other for checking and sealing the divers' shares in gunny bags. There were nearly half a dozen menials to help these officers.

As the boat came alongside the schooner, every diver, one after another, handed his collection to the officer who made three equal divisions, giving one to the diver and appropriating the remaining two on behalf of Government. In the meanwhile the checker put the diver's share in a gunny bag, sealed it and handed it over to the particular diver who went back to his boat. When all the divers got back their shares and the tindal received his old permit filled in with new details and countersigned by these officers, that boat was ready to go back to shore. Other boats were dealt with in a similar way. They were all ready now to go back. They reached the shore from two to three hours in fair weather from the time they got back their permits.

Sometimes it was very difficult to make divisions at sea owing to the high winds and choppy seas. Under these circumstances divisions were made on land after the boats had gone back under escort and deposited their collections in the Government Kottu or store.

The fishing boats arrived ashore in groups or one by one as the case may be and there was usually a huge crowd on the beach to welcome them.

The staff of the Beach Master was very busy on the beach when the boats arrived. They were scrutinizing the sealed bags of divers, getting back the permits already issued to them overnight and searching the boats for any misappropriated oysters. When they were satisfied, they allowed the divers, the mandacks, the crew and the tindal to go ashore.

Retail Selling and Retail Buying.—As already stated above, every diver has to pay the tindal and the mandack, the former for the hire of the boat and the latter for the services rendered at sea. He paid both the people in kind. He made six equal divisions of his share, retaining four of them and giving the remaining two to the tindal and the mandacks respectively.

These people now retired to the sales ground to sell their oysters. Retail buyers could buy them from one oyster upwards. The average retail price varied from twenty to forty oysters to a rupee. On an average a diver made about ten to twenty rupees a day.

A retail buyer cut open his oysters in another part of the same ground, anxious to see what his oysters contained.

In the meanwhile the Government transport boats arrived with the Government share which was handed over to the Kottu manager. These oysters had been already counted and bagged, five hundred in each bag, at sea. They remained in the Kottu till they were delivered next day to those who had bought them at the public auction.

Public Auction.—A public auction was held every night at 8 or 9 p.m. in the auction hall. Half an hour or so before the auction began, a gun was fired to apprise prospective bidders of the event.

The auction hall was built on the central portion of a raised platform. Inside the hall were seated the Director and his staff, while in the open the public waited for the auction to begin.

The Director sat by himself on a raised platform, while his staff consisting of voucher makers, checkers and treasury clerks sat in front of him facing the public. There was a bamboo railing separating the public from the staff.

At the appointed hour the auction began, nobody was allowed to bid for less than one thousand or more than twenty-five thousands oysters. One of the peons standing in front of the staff, facing the public, announced the numbers of the oysters Government had for sale that particular day. On an average it amounted to one lakh and fifty thousand oysters daily.

Bidding per thousand went on till a certian price became stable for some time when some bids were accepted at that price. The price usually ranged between rupees thirty to fifty per thousand. Those whose bids were accepted at that price were admitted one after another into the hall where every one of them was required to get a voucher containing his name and the number of oysters he had bought. He presented this voucher to a treasury clerk who wrote the same details in his ledger and received a deposit, generally 1/10 of the whole amount of the purchase and gave a receipt for the same.

Bidding went on in the manner described above, till all the oysters of that day were sold out.

Next day the buyers presented their deposit receipts to the cashier in the treasury and got receipts for full payments which they presented to the Kottu manager. The latter gave them delivery of their goods.

On an average Government got a net income of Rs. 5,000 to Rs. 6,000 per day. But this income depended on various factors. Fair weather, calm sea, favourable winds, no under currents, warm day so that divers found it comfortable to dive, presence of efficient divers, place for fishing on the banks rightly located, pearls properly valued, presence of bidders and pearl merchants, good sanitation in the camp, absence of strikes, etc., all these conditions, individually as well as collectively increased the income or decreased it if any of them was adverse. Presence or absence of these conditions makes or mars pearl fisheries.

Rotting of Oysters in Thotties.—After the delivery of the goods, the buyers took their loads of oysters to their respective Thotties. Use of these Thotties was auctioned and Government got a good income out of it.

These Thotties were located on the beach far away from the camp, since they might become the source of an epidemic like Cholera as the oysters were being rotted in them. The four walls of each thotty were constructed of bamboo thatties with a small entrance but it was open to the sky. Each hut or thotty measured about 30 × 30 × 8 ft.

In these thotties then, the oysters were dumped in heaps for rotting purposes. Various agencies worked together for macerating or rotting the soft parts of these oysters. Heat engendered by the heap produces the optimum conditions under which various kinds of flies, mostly Calliphora, Lucilia and Sarcophaga, lay their eggs or larvæ. The latter which are voracious feeders of offal complete, with the help of bacteria, the maceration within four or five days. The soft parts are now turned into homogeneously pulpy material which emits vicious and repulsive odour.

After the fifth day these oysters or whatever remains of them were washed in a small dug-out or a tin bath or in a still smaller vessel according to the number of the oysters to be washed. After stirring or churning the contents and throwing away empty shells, the container was filled to the brim with sea water and kept over night. The next morning the superboyant liquid was slowly decanted and the contents again washed. This process was repeated so many times that a fine powered stuff was left behind. It was then spread out on a black piece of cloth and left there for drying. After it was thoroughly dried, a vigorous search for pearls was made on the spot or the whole stuff was taken home or to a shop where thorough search was made at leisure.

Pearl Bazaar.—There were sixty to seventy pearl shops or huts located on both sides of the main road. These shops were rented out to pearl merchants.

In these shops pearls were sold or bought or merely exhibited for show. In some of the shops fine holes were drilled into pearls which were then sewn into threads and were exhibited for sale. There were also people in this bazaar who bought blisters of the pearl shells and made cheap pearls out of them by careful filing.

Lastly my cordial thanks are due to the Director of Fisheries and his whole staff of the Pearl Fishery for the courtesy shown to me and for the trouble they underwent in taking me over all the operations involved in this Fishery. I also thank the Government of Bombay which allowed me to study this Fishery on the spot.

MODERN MUSEUM METHODS

BY

S. H. PRATER, C.M.Z.S.

Curator, Bombay Natural History Society

PART I

(*With six plates and five text figures*)

Since one of the main objects for which a Museum is established is the ' diffusion of instruction and rational entertainment among the mass of the people ', it follows that, apart from the purely scientific research and investigation which it carries out, the collections which are open to the public in its galleries, however rich, important and complete they may be, are only of real value to the extent to which they are made use of by the public and to the extent to which the public is able to benefit by the instruction and entertainment they are intended to afford.

Now the attitude of the public to the museum might often be expressed in the words of a certain New England farmer who, after enumerating the many virtues of his deceased wife, concluded by saying ' somehow I never liked the woman '. The public realizes more or less that the museum is an institution intended for its benefit but somehow does not like it. May not the reason for this attitude be explained by the fact that many museums are dehumanized institutions, completely lacking in attractiveness because of their unsympathetic treatment of the public and their unsympathetic methods of presenting their treasures ?

Shortly after arriving in New York, I read an article in one of the Sunday papers dealing mainly with the work the Museums were doing for the people of the country. ' In America to-day,' the writer pointed out, ' the Museum fills the role of educator, entertainer and nursery companion ; it has ceased to be a dusty warehouse of antiquities and has become a bright and cheerful instruction centre for the community.' After a few months spent working in and visiting many of the Museums in the country I realized more clearly the truth of his contention. Like everything else in American life, the Museum has developed into an institution with the motto ' service to the public '. The national spirit is expressing itself in these rapidly growing institutions--efficiency, gaiety, and democracy —these characteristics already differentiate the museums of America from those of other lands. One finds efficiency in their careful study of the comfort of the visitor while in the museum galleries and in their almost perfect methods of charting, casing, and labelling. One finds vividness and charm in their methods of exhibition, and democracy in the wide appeal they make to the public at large. Art and Science are learning to work together. The Science Museum calls on the artist for ' atmospheric effects of nature ' and the Art Museum looks to the scientist to arrange its treasures in some intelligible progression. The result is the creation of museums which are really attractive to the masses, of museums which look to and receive public support. The impression one receives is that these museums are unique in their history, progress and purpose; they cannot be compared with kindred institutions in the old world. Their appeal is not so much to the advanced technician or craftsman as to the man in the street. Except in the case where qualified guides conduct parties of visitors over its galleries, the teaching of the museum is silent teaching, and to be successful this teaching demands an effort on the part of the visitor. How far is this effort forthcoming? Now one might say that 90 per cent. of the people who visit a museum visit it mainly for pleasure and with the majority the message, the museum has to offer, loses much of its meaning unless it can provide something which arouses and holds interest. To deluge people with facts and to offer too much to their attention results in getting very little of it. The story of the monkey who was unable to get his handful of nuts out of a jar until he had dropped some of them has its application here. The neck of the jar is as large as the public interest, no larger—to grab too much attention is to lose it. To get the public to look at and absorb what you offer you must drop some of the nuts. One cannot teach people by marshalling whole series of facts before them. It is the principles that matter; facts will soon be forgotten while the principles remain. In offering the visitor principles which are new and unknown to him it is necessary to commence with something that is familiar and known to him. Our understanding and acceptance of a thing depends much on what we already have in our consciousness. Introduce something which has no connection with our past experience and we are not interested. To hold our interest there must be a large ingredient of the familiar with the unfamiliar. Edward Fisher in speaking of museums and their work said, ‘ The great purpose of Museums is to stimulate the observant powers into action. The educational value of museums will be in exact proportion to their powers of creating new thoughts in the mind’.

The object of the museums is therefore to lead the people to better ideals and to offer them new view-points in a way which they can understand and appreciate. The appeal is made more to the senses than to the intellect but it is made in such a manner that in addition to mere attractiveness it offers food for thought which is the first step to a higher and more intellectual ideal.

There are many ways of telling the story of nature. Why not choose the beautiful way? The way which leads from an appreciation of its interest and its beauty to an understanding of its meaning. It is the method which will make the widest appeal. A second reason is the obtaining of public support. By giving the public something which it can understand and appreciate and something which it wants, the museums succeed in rousing its interest and ultimately its support. And in this the American Museums have been completely successful.

A study of the methods adopted by museums in the United States in serving their public would perhaps repay the Museums of other countries. The stress and strain of modern life, and the demand that it makes on the time and attention of the average wage-earner, does not leave much time for such side issues as Art and Natural History. It is a condition that is becoming increasingly prevalent not only in America but also in the older countries. Dr. Van Straelen, the Director of the Natural History Museum, Brussels, with whom I discussed this aspect of the question believed that the democratic spirit of modern times necessitated a change in the attitude of museums. The old museums were aristocratic, their show galleries were merely in the nature of a concession, but modern conditions necessitated a change in this policy. The museums were becoming more and more dependent on public support, on money voted for them by the people's representatives, and unless museums did something for the people the money would not be forthcoming. 'Applied science will find its votaries and its supporters' continued the Doctor, 'but for pure science we will have increasing difficulty in finding money. We arrange our galleries on the plan of a text book where specimens, models and explanatory labels trace in outline the various classes of the animal kingdom. This type of exhibition was necessary and useful for the more serious students, but the great majority of our visitors are not serious students and for them we want something else. There must be some 'light houses' in a gallery to draw their attention and rouse their interest.'

At the Natural History Museum, Berlin, radical changes are being made in the character and nature of the exhibits. There, too, the museum is making a bid for popular interest and support by the introduction of methods of exhibition which appeal to the lay visitor. For if the institutions which stand for the cultural development of the people are to succeed in their mission, it has become necessary for them to alter their standards, to break down their aloofness and restraint—that attitude of mind which looks on the visiting public as something in the nature of a nuisance, and come down to a more sympathetic consideration of the people's wants. Some may object. Why appeal to peoples' wants? Their wants may be stupid, childish or even positively mischievous. What we must appeal to is their reason. Professor Overstreet in his interesting series of lectures on 'The Influencing of Human Behaviour' gives us the answer 'No appeal to reason can ever be successful if it is not also an appeal to a want'. An understanding and appreciation of the truth of this axiom will save much time in argument. If one of the main motives of a Museum is education not of the few but of the mass, and if this education is to be effective, it requires the rousing of the popular interest in its activities as a first step, and it is the duty of the Museum Director to make his museum worth being interested in, to give his museum such vitality and pertinence that people will want to be interested in it, will want to visit it, and will realize the necessity of supporting it, and though the people may want something quite inferior, his problem is to get them to want something worthwhile, and to give them the opportunity for these more worthwhile wants to multiply and grow.

I will now pass to a consideration of the methods adopted by Museums in the United States and on the Continent to attract and maintain public interest and support. The subject may be divided under two headings :

1. The Museum Galleries as a whole.
2. The nature and methods of arrangement of the exhibits.

1. General Treatment of Galleries

The principal factors which react on the mind of the visitor on entering a gallery are—

1. The architecture and colour of the walls and the show cases,
2. The show cases themselves and their general arrangement,
3. The exhibits.

The third factor being the most important, it necessarily follows that the first and second factor should be subordinate to the most effective presentation of the third.

We will leave the question of architecture aside for the present. The museum curator is rarely in a position to decide the architectural requirements of the building he is to use. The question of the colour of its walls is a matter which might easily come within his province to decide. It is not difficult to realize the importance of colour as a means of attraction. Even as children we were attracted rather by colour than by form. We retain this impulse throughout life, only we temper it by a new desire for a pleasing arrangement or harmony of colours. Our objective should therefore be a pleasing colour scheme, that harmonious blending of show cases and walls which will be most effective in the presentation of the exhibits shown in the gallery.

Colour Schemes.—As a general rule quiet colours should be utilized. The choice of colour will depend largely on the lighting of the room and the objects to be displayed, but the rule in its selection should be the avoidance of an obtrusive scheme which will draw to itself the attention of the visitor. At the Brooklyn Museum, the show cases and walls in the hall of Invertebrates were painted a bluish-grey ; the effect produced was restful and pleasing. In the Mammal Gallery at the Natural History Museum, Altona, Hamburg, the colouring of the walls and show cases was very harmoniously conceived. In the main Mammal Hall the walls had a 6′ 6″ dado of dusky slate blue relieved with a faint grey stripe, the upper portion of the wall was carried out in Rejane green [1] and the contrasting areas of colour were divided by narrow black lines, the pedestals of the show cases corresponded in colour to the dado, their upper framework was in black, while the backgrounds were grey stippled with green. In the Bird Gallery in the same museum the dado of the hall was in nickel green, the upper surface of the wall cream buff with a white area where the wall joined the ceiling. The pedestals of the show cases were treated in a similar tone of green as the dado, while their frames were black.

The selection of a colour scheme should be governed by the type of exhibit shown in the gallery. Certain exhibits require quiet tones, others more brilliant ones to give them their full significance, particularly where colour in the exhibits themselves is wanting. A rather daring and original colour scheme is to be seen in the Ethnological Gallery at the Brooklyn Museum. This hall is divided by its architecture into three sections, the columns supporting the ceiling forming the divisions. Each section is confined to illustrating the arts and crafts of a distinct race. In the first section the show cases were green, in the second royal blue and in the third rose pink. The plinths of the adjoining pillars were coloured to correspond with the show cases. Thus in the same hall one had three aisles of show cases painted in different colours. After passing through several galleries where drab or neutral tones predominated, this original colour scheme had the effect of renewing and re-arousing one's attention. The eye was greeted by something fresh and colourful and the effect was not unpleasing. Rejane green makes an excellent background for animals and birds. It is used in the galleries of the Munich Museum and is perhaps the most successful colour tone I have seen used in any Museum in connection with these types of exhibits.

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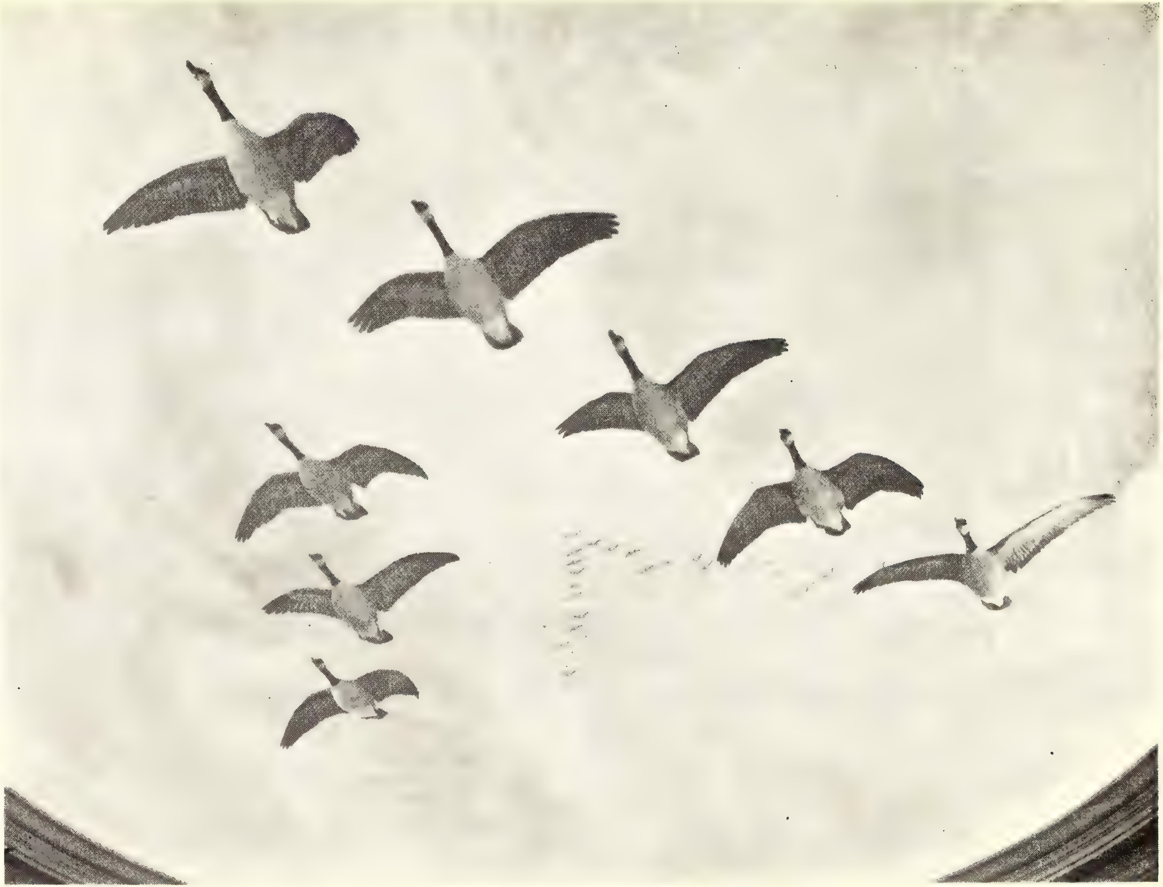
[1] Ridgeway's Colour Standards, pl. xxxiii.

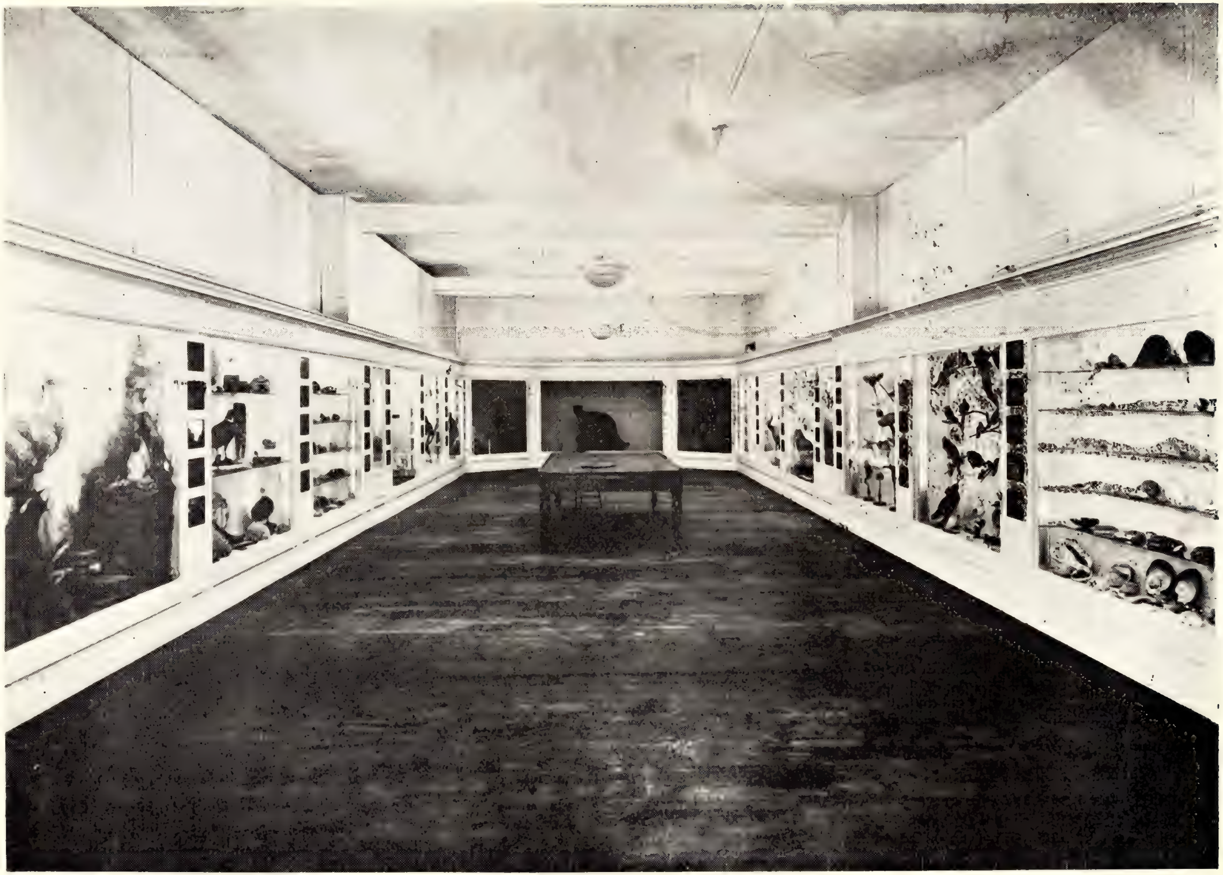
Atmosphere.—The colouring of the walls and the show cases to produce a desired ' atmosphere ' is another point which deserves consideration. In the Invertebrate hall at the Brooklyn Museum, where the majority of the exhibits were illustrative of life in the sea, the blue grey colouring of the walls gave a marine note to the gallery which was further accentuated by mural paintings depicting seascapes in various quarters of the globe. In the new Fish Hall at the American Museum, the colour of the walls is grey with a stippling of waved blue lines giving them a watery effect; the backgrounds of the cases against which the fishes are shown, had the same colour motif in a slightly darker tone, the whole object being to give a ' marine atmosphere ' to the gallery. Artificial light through lanterns of greenish glass increased this effect. The whole question of the colour in a museum gallery is a phase of museum work which requires study, it is now in the experimental stage. It marks an advance in museum methods. Its object is to please and attract the visitor by creating an atmosphere which will produce a subtle reaction on his mind and in any way prepare him to enjoy and appreciate what he sees.

Mural Paintings.—A further development is the decoration of the walls with appropriate mural paintings. Many museums are now adopting this method of decorating their galleries. We find galleries of Art, Archæology, Geology, Ethnology, Zoology and Botany decorated in this manner. Apart from their purely decorative effect, murals have a distinct educational value. They are a clear and simple means of transmitting ideas—they are tools for communicating thoughts, stimulating interest and arousing feeling and emotions. Where a range of exhibits is shown which requires a mental effort on the part of the visitor to clothe them with the interest they merit, these pictures will supply the required stimulus—will supply vividness and drama to what might otherwise have been a barren theme. In the hall of the Age of Man in the American Museum, where the exhibits illustrate successive stages in the history of man, the dry bone atmosphere was to a large extent relieved by the beautiful murals adorning the walls of the gallery. The fleshless skull of the Cro-magnon man springs into life in the mural painting depicting the Cro-magnon artist at work painting his procession of mammoths in the cavern of Font-du Gaume in France. At Altona, Hamburg, the walls of the Bird Gallery were ornamented with paintings of individual birds or groups of birds; such subjects



By courtesy *Amer. Mus. Nat. Hist., New York.*

PART OF DOMED CEILING OF BIRD GALLERY, AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.



By courtesy *Buffalo Soc. of Nat. Sciences.*

MODEL OF EXHIBITION HALL DESIGNED FOR THE NEW MUSEUM OF NATURAL SCIENCES, BUFFALO, NEW YORK.

as geese in flight or a soaring eagle gave a charming and appropriate setting to the exhibits. The vaulted ceiling of the Bird Gallery at the American Museum of Natural History is painted to represent a sunset sky against which we see various birds in flight—actual specimens are used and as these recede further into the distance they are substituted with painted birds, the gradation in size and the perspective is cleverly maintained and the effect altogether is realistic and charming. (*Vide* Plate 1).

There are certain points to be remembered in decorating the walls of a gallery with murals. Firstly, a mural must preserve the flatness of the wall it decorates. It should not mar the architectural lines or destroy the even level of the wall's surface by giving it an effect of contours. Mr. Charles Knight, one of the most successful animal painters in America told me that he preserved the desired flatness in his murals and yet gave them an effect of roundness by painting them always with the light coming up from behind, so that the objects were more or less silhouetted against the background and yet had a feeling of depth.

Then again as regards colour tones, these should always be ruled by the type of exhibit in the gallery. Where one is exhibiting skeletons or fossils and such like colourless material, a certain latitude in colouring is permissible but in a gallery where the exhibits are themselves colourful, restraint is necessary in the colour of the murals so that a harmonious effect might be obtained. In every case the murals should be a subordinate feature and should not become the centre of attraction. In the old African hall at the American Museum the murals illustrating scenes of African life were done completely in sepia. In the new Reptile Gallery which contains many beautiful and vividly coloured groups, the murals are being painted in quiet shades. Small colour sketches of these murals were first done to scale, subsequently a full sized copy was done on cheap muslin, this painting was fitted to the walls to see whether it harmonized or clashed with the exhibits ; certain colours were then reduced and other heightened till the desired effect was achieved. I have written at some length on this subject because I believe that our museum offers an excellent field to our school of mural painters in Bombay, it will afford them the opportunity of showing their skill to the people of their own city and of having their work exhibited where it will be seen by thousands. Natural History offers them an endless range of subjects while the Archæological and Art sections could also be made a venue for their skill.

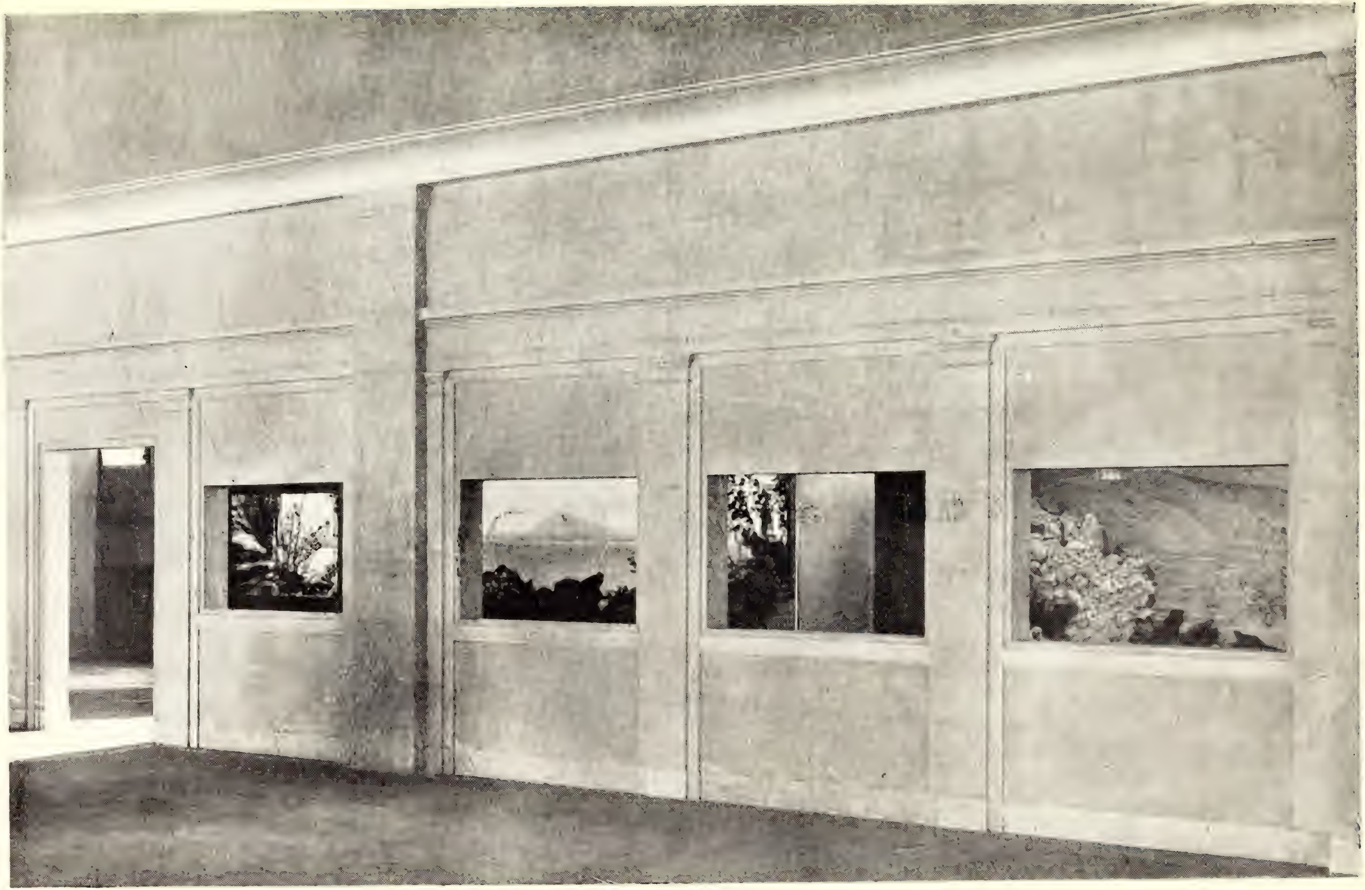
Arrangement of Show Cases.—The second factor which draws the attention of the visitor on entering a gallery are the show cases and their arrangement. A gallery crowded with tall show cases whose massive wood work and external finish makes them unduly conspicuous carries with it a decidedly forbidding aspect—it creates a feeling of heaviness and artificiality which can be thoroughly depressing, and its effect upon the visitor is to repel rather than attract. The overcrowding of the gallery with show cases and the cases with exhibits appals the visitor who quickly realizes that he will never be able to absorb a tenth part of what is offered him.

The arrangement of the show cases and the type of show cases to be used in a particular gallery will depend largely on the architectural features of the room, its lighting and the nature of the exhibits to be displayed, but the general attractiveness of the room and the effect of its arrangement upon the visitor is a point always to be seriously considered. The accompanying photograph (Plate II) illustrates a model exhibition hall designed for the new Buffalo Museum. It will be seen that the cases are let into the walls of the room—they are of the ' built in ' type, their breadth varies according to the nature of the exhibits to be displayed. In the present instance the cases along the sides are 18'' deep, those at the head of the gallery which are intended for groups are 6 feet deep. This is one method of arrangement which is very successful and very attractive. It gives an air of spaciousness even to a small room and is adaptable to any type of exhibit.

A second method of arrangement is seen in the new Reptile Hall in the American Museum. The floor of the gallery is occupied by a series of small metal-framed box cases none of them exceeding 4 feet in height, the walls on one side have a series of 'built in' groups (*vide* Plate III) while the opposite wall has a series of vertical cases arranged in the form of alcoves. The use of only low cases for the floor gallery is an advantage in that, there is nothing to obstruct the view of the visitor from the gallery as a whole and that atmosphere of cumbersomeness and artificiality produced by an assemblage of tall show cases is largely obviated. The use of the centre of the gallery for some artistic and dominating exhibit is an effective method of adding to its attractiveness. This is seen to good effect in the design for the new hall of African Mammals at the American Museum of Natural History, New York, where the central exhibit will take the form of a magnificent group of African Elephants mounted as a memorial to the late President Roosevelt. In the Mammal Gallery at the Altona Museum, the centre of the floor is occupied by the skeleton of a horse mounted on a high pedestal, the walls are lined with ' built in ' cases, while the main floor space is occupied by low box cases illustrating life histories of mammals.

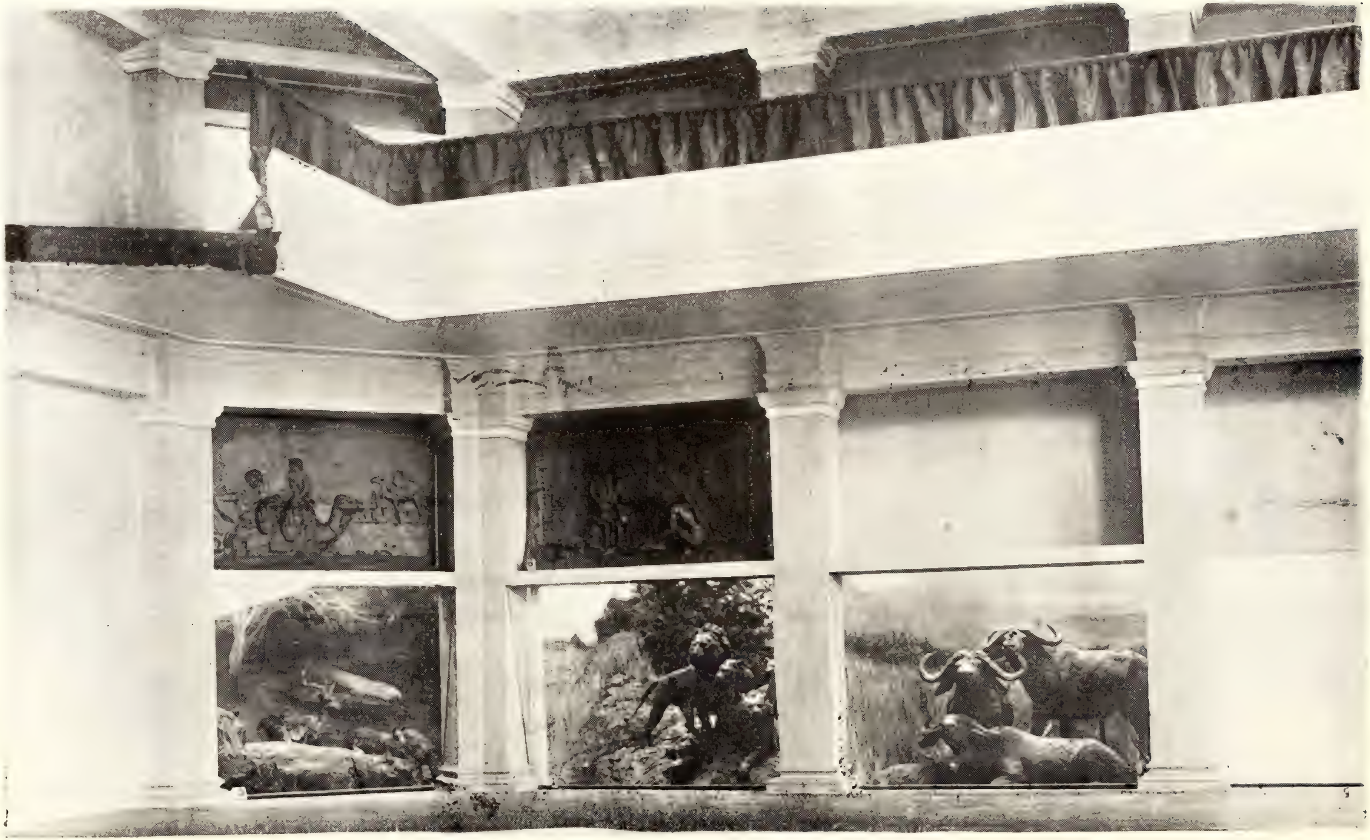
It has been shown that by introducing the 'built in' type of show case, the necessity for large cases on the floor of a gallery, is largely obviated. High show cases on the floor of the gallery obtrude on the visitor and obstruct the view, while the use of the floor space for low cases only gives airiness and spaciousness to the hall and facilitates guarding. The arrangement of cases as alcoves while it is effective in focussing the attention of the visitor on one part of the gallery at a time, has the disadvantage of making the policing of a gallery difficult. The use of a prominent central exhibit acts as a ' light house ' to attract the visitor.

Show Cases.—In addition to the problem of attractiveness the Museum Curator has another problem—a very important problem —and that is the prevention of fatigue. The visitor sees the museum galleries not only with his eyes but also with his protesting feet. Visiting a museum takes time and while the visitor takes his time it will be more difficult for his brain to take in new impressions, if the rest of his bodily organism is crying out for attention. Benches with restful backs are a great necessity in a museum.



By courtesy Amer. Mus. Nat. Hist., New York.

NEW REPTILE HALL, AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK, SHOWING 'BUILT-IN' GROUPS.



By courtesy *Amer. Mus. Nat. Hist., New York.*

MODEL OF NEW HALL OF AFRICAN MAMMALS, AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.

The supply of seating is a necessity which is quite often made conditional on available space, but if the comfort of the visitor is to be seriously considered, then the provision of seating accommodation must be made an essential feature in the planning of a gallery.

At the Altona Museum, Hamburg, I saw a space beneath a window between two show cases effectively used for a seat. The second source of fatigue is eye strain, caused firstly because the objects shown are placed either too high above or too low below the level of the eyes, secondly because the exhibits are placed too far from the eyes and thirdly because objects are placed in long monotonous rows.

The structure and design of museum show cases in which museum exhibits are shown are an important factor in helping to remove many of these disadvantages.

The older type of show cases were characterized by their heavy wooden frames, their ornate dust-catching design, abnormal length, height and depth, low bases, horizontal sashes obstructing the view and hinged or sliding doors. All of these features were a disadvantage from the visitors' view point. The modern museum case is distinguished by its narrow framework, reduced length, depth and height, its relatively high base which does away with the necessity for stooping, its large area of plate glass, no obstructing sashes and easily removable knock-down sides instead of hinged or sliding doors.

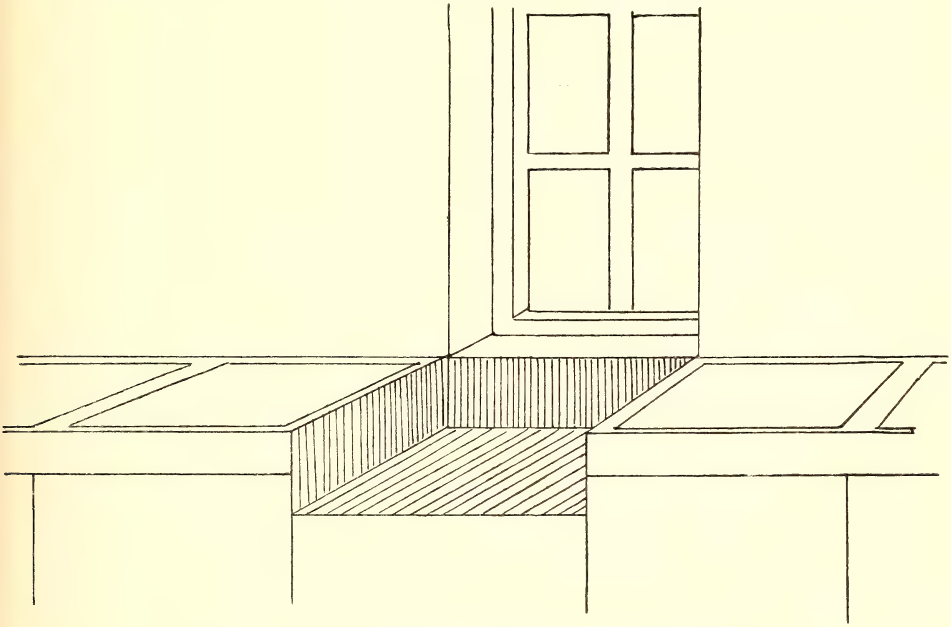


FIG. 1. WINDOW SEAT FOR VISITORS, ALTONA MUSEUM.

All museum cases may be classed under two headings, i.e., cases in which the exhibits are shown on a horizontal surface (horizontal or desk or table cases) and cases in which the exhibits are shown on a vertical surface (vertical or wall cases) a comparison of the advantages of the two types yields the following results :—

Vertical case.	*Horizontal case.*
Maximum of exhibition space with minimum or floor area.	Maximum floor space with minimum exhibition area.
Clean glass (vertical glass is rarely touched by the visitor).	Soiled glass (horizontal glass is leaned upon and touched by every visitor).
Comfort for the visitor.	Discomfort, the body must be bent at a fatiguing angle to see the exhibits.
Well and evenly lighted objects, absence of eye-strain.	Visitor obstructs the light as he leans over the case.
Adaptable for any kind of object.	Can only be used for small objects.

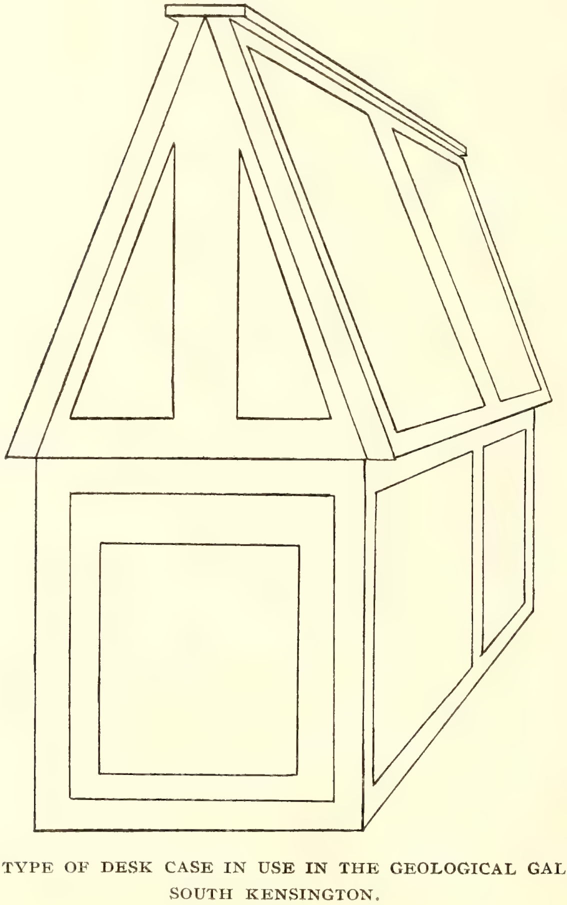


FIG. 2. TYPE OF DESK CASE IN USE IN THE GEOLOGICAL GALLERY, SOUTH KENSINGTON.

Owing to its many disadvantages the tendency to use the horizontal or desk case is steadily decreasing, as exhibition cases of the vertical type appear to be the most practical and economical for use in a museum gallery. A very practical substitute for the ordinary type of horizontal or desk case is the type of case illustrated in the accompanying diagram ; by increasing the height of the case and subsequently the angle of the slope a larger exhibition area is made available without the occupation of additional floor space. The exhibits are thrown into better relief and the objects more evenly lighted, the glass is not leaned upon and the necessity for stooping is obviated. This type of case is in use in the Geological gallery at South Kensington, London. The case has a solid base which provides storage accommodation. The solid base has been much in use in museum show cases as it provides storage accommodation for exhibits not on display. Where a sufficiency of storage accommodation is not available, this is imperative though not always convenient, the disadvantage of the use of the high solid base for horizontal cases is that it detracts from the appearance of the case, is more expensive and makes policing of the gallery more difficult. On horizontal cases of the desk and table type, where the base is 32″ from the ground, the use of a leg base is preferable.

In arriving at the most suitable height for the base of a case the comfort of the visitor should always be taken into consideration. The placing of small objects a few inches from the floor level, as is often done in museums, is perfectly useless as the visitor would either have to go on hands and knees or bend down at an uncomfortable angle to see them, and this he is usually unprepared to do with the result that the exhibits so placed are rarely looked at. It would be better to sacrifice this space and limit the area available for exhibition to a suitable height from the ground where the exhibits would have a better chance of being looked at. The eyes of the average person are 60″ from the ground, the most comfortable visual distance averages 1 foot, the body may be lowered 15° without stooping. To prevent eye strain on the part of the visitor and the necessity for excessive stooping the bases of all desk and table cases should not be lower than 32″ from the ground and the objects within these cases should not be further than 2-4″ from the glass. In wall cases, the height of the base should not be lower than 24″ and the depth of these cases should not be in ordinary circumstances exceed 18″ while the height at which objects are shown should not exceed 62″.

The modern museum group requires a special type of case. The most effective case for the purpose is the type which is ‘ built in ’ and shows none or very little framework, the group being viewed as through a window in the wall of the gallery.

This type of case is particularly suitable for large habitat or zonal groups, but the possibility of its use will depend on the architecture of the hall, and in the construction of the modern museum galleries special provision is made for the installation of these built-in cases. The accompanying photo (Plate IV) shows series of built-in groups in the design for the Hall of African Mammals of the American Museum of Natural History, New York.

Lacking requisite architectural facilities, group cases may be installed on the floor of a gallery and built in the alcoves formed between large floor cases. One such group was recently installed in our Museum. It is built between two large floor cases. It is 14 ft. in length, 7 ft. deep and 11 ft. high—the window measures 6 ft. × 4 ft.

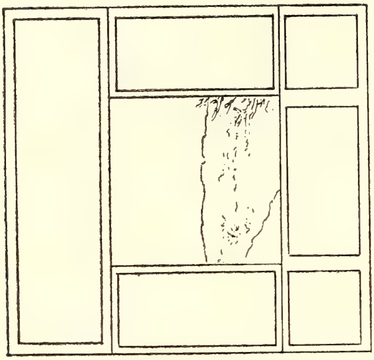


FIG. 3. Front view of Group Case. The panels on each side may be used for photographs or transparencies.

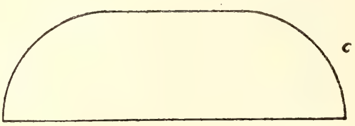


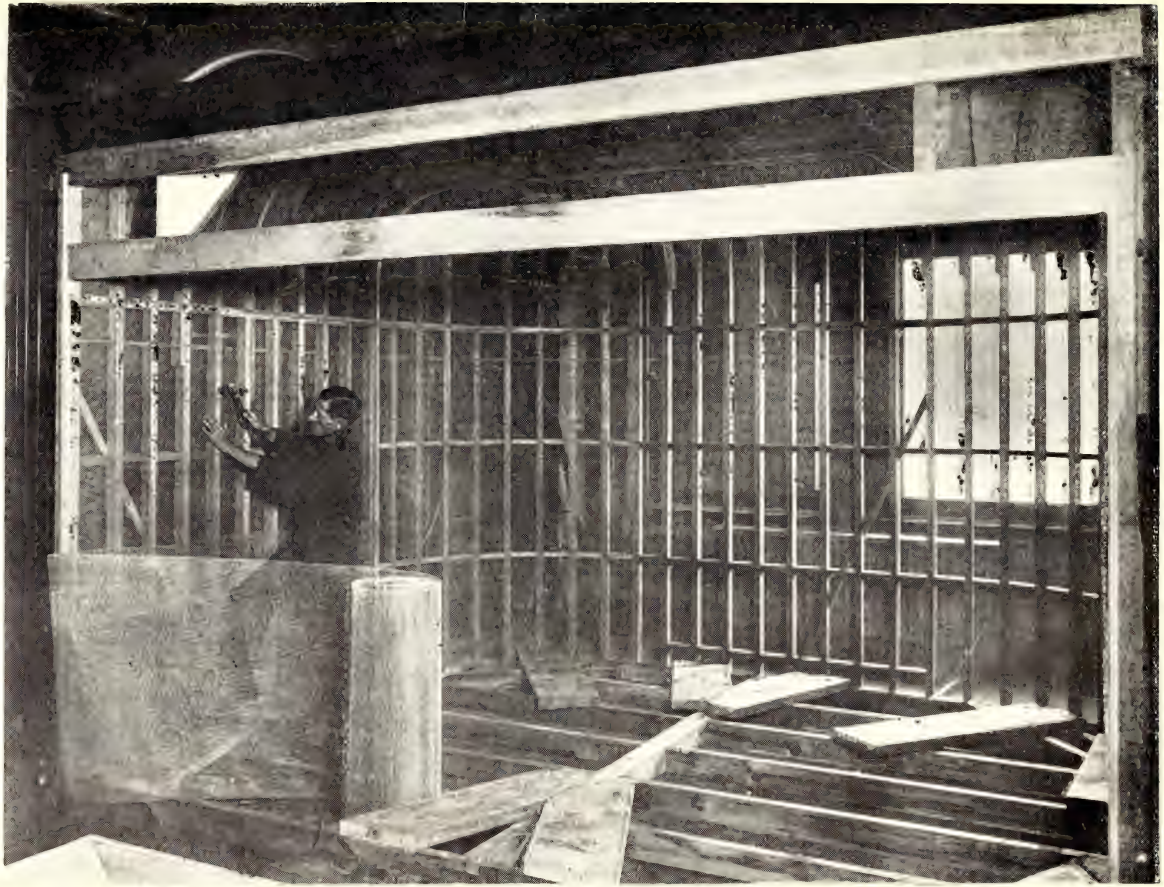
FIG. 4. Ground Plan of Group Case showing curve of Background.

As regards dimensions of these cases the most satisfactory rule is to have the length double the depth. As regards the background its main portion is flat but where it approaches the sides of the case it takes a gradual curve. The sides of the case should not be too long as it is difficult to avoid a 'strained' angle in the objects painted on it.

The ceiling or top of the case should be made as high as possible so that on looking at the group the visitor does not see the line where the painted background meets the top of the case. Reflections from outside the case generally mar the effect of many museum groups. To avoid reflections, the volume of light within the case must be greater than the volume without, and in groups of this type artificial illumination from within is nearly always necessary. By its use any desired lighting effect may be achieved. The lights are generally placed behind the upper portion of the front panel of the case. To avoid shadows and to shed a diffused light within the case, the reflectors of the lamps are directed towards the top of the case from which the light is deflected on to the objects below, or the light may be thrown on to a white painted board attached on hinges and placed immediately in front of the lights. By fixing this board at any required angle the volume of light reflected into the case can be controlled.

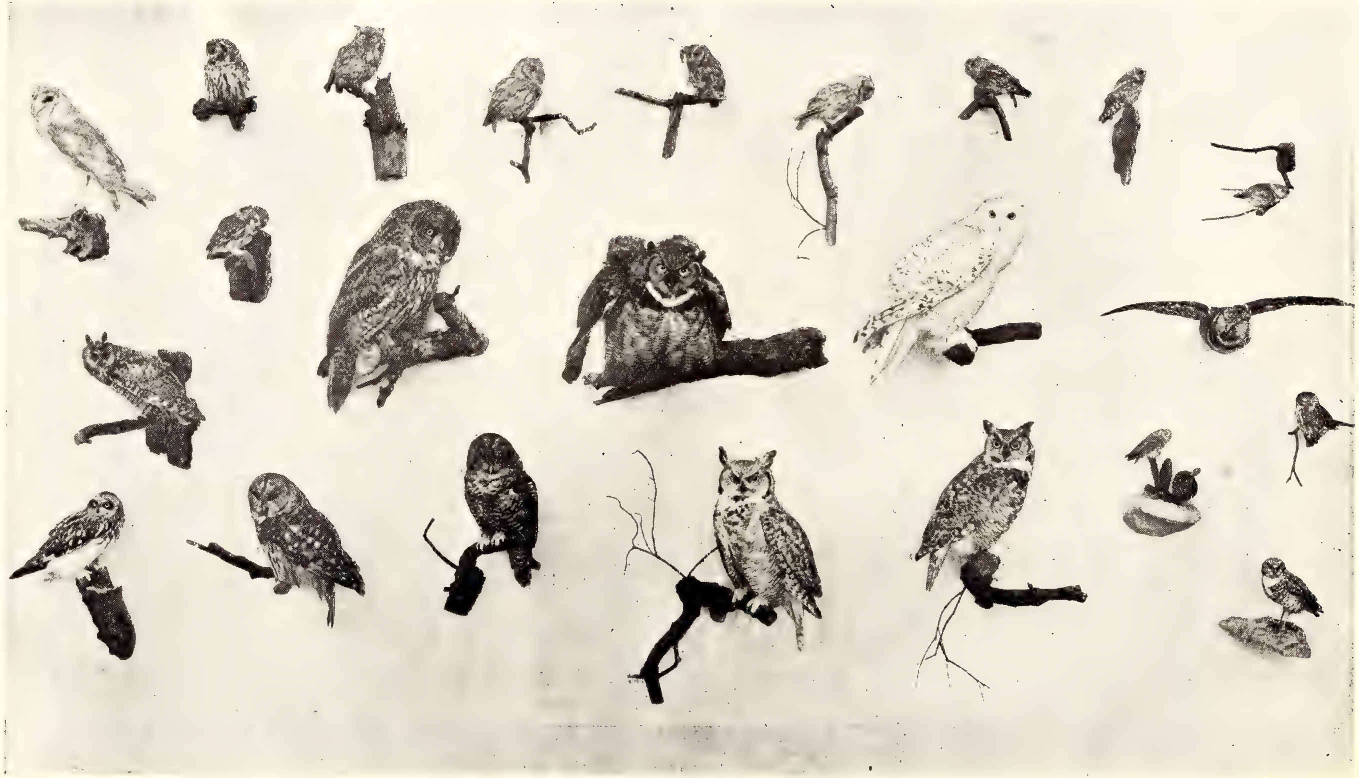
Reflections may be further reduced by fixing the front glass of the case at an angle, the degree of the slope being one inch to every foot of height.

As regards the construction of the curved background this may be done as follows. A form with the required curve is built by running up 2″ × 4″ joists which are held together with cross bracings (Plate V). This form is then covered over with pieces of



By courtesy *Amer. Mus. of Nat. Hist., New York.*

CURVED BACKGROUND IN COURSE OF PREPARATION FOR A GROUP AT THE AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.



By courtesy Field Museum, Chicago.

A CASE OF BIRDS SHOWING THE SHELFLESS METHOD OF EXHIBITION.

plaster board which are screwed into it. The plaster board is made by running plaster into flat or curved moulds as required and introducing layers of fibre and burlap into the plaster before it has set.

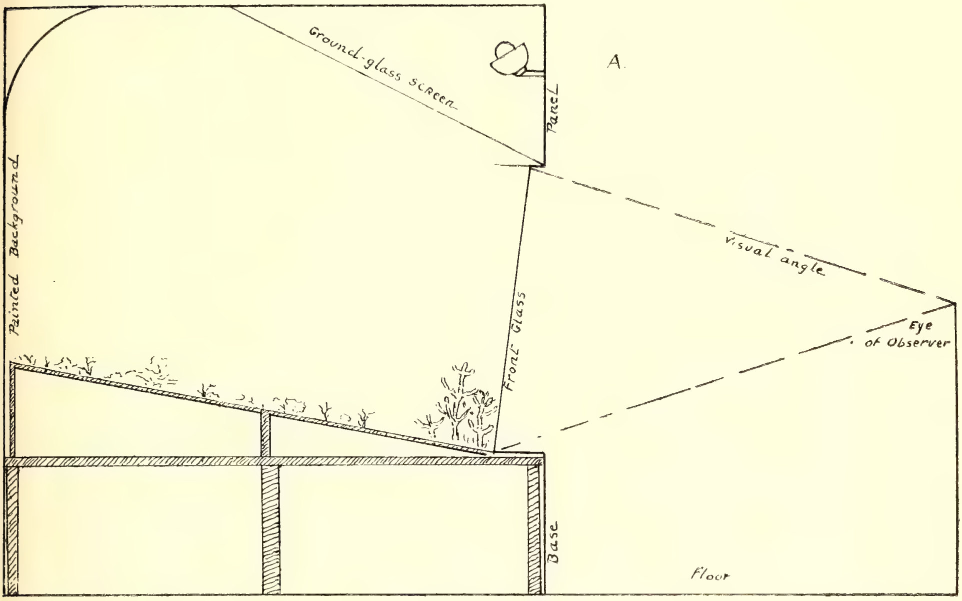


FIG. 5. Side view of Group Case.

When the whole form has been covered with plaster board the joints between the boards are filled with plaster, the whole surface is then sand papered and coated with shellac and when dry painted with two to three coats of white zinc. An alternative method is to cover the form with wire mesh, machè is then forced into the mesh and spread evenly over it. It is then shellacked and allowed to dry—when dry a second layer of wire mesh and machè' is laid on and then a third, each layer being shellacked and allowed to dry before the next one is added. It is then white leaded and covered with muslin as previously described. The photograph illustrates a group case in construction at the American Museum of Natural History, New York. A third method is to cover the curved form with strips of ½″ × ⅛″ wood, then coat the whole surface with shellac. When dry, mix varnish and white lead to a syrupy solution, strain it through close-meshed wire netting and brush it over the surface doing one section at a time, covering each section as it is brushed with a layer of muslin which must be rolled on quite smooth. When dry the whole surface is coated with white lead—a good quality of white lead must be used—the poorer qualities turn yellow after a time and have a bad effect on the painting.

Smaller groups are constructed on the same principle and will often be found more practicable where conditions of space make the installation of large groups impossible—a consecutive series of small groups illustrating the life histories of small mammals, birds, reptiles, fishes or insects can be effectively arranged along the walls of a gallery.

For the small museum one can do much more with small groups and show much more than with large groups. The background of these groups, if curved, can be made of cork lino screwed to a curved form, or of card board. At the Colorado Museum the backgrounds of the cases consist of coloured photographic transparencies on ground glass—the photograph illustrating the actual environment of the species forming the subject of the group.

Shelves.—In many museums the use of shelves within the cases is being done away with because they tend to produce a monotonous lineal form of arrangement. The shelf is being replaced by the individual bracket which supports the specimen against the background of the case. Most objects shown in museums lend themselves to this style of exhibition. The accompanying photograph (Plate VI) shows a case of birds in the Field Museum, Chicago, where the customary shelf has been substituted by the bracket. The Shrosbree bracket, a simple and efficient contrivance, which can be accommodated to both small and large objects will be found most useful for the purpose. It is supplied by the Public Museum and Library, Milwaukee, Wisc. The use of the bracket offers greater freedom of arrangement and better use of available space—the objects are brought into sharp relief against the background and an even distribution of lighting is assured. The labels are either fixed to the pedestal supporting the specimen or are placed in metal holders screwed into the back of the case.

We are adopting the shelfless method of arrangement in our Bird Gallery to very good effect.

For the background of our case we have used a screen made of 2 thicknesses of 3 ply wood fitted into a frame within the case so that the screen with the exhibits on it is removable.

In arranging the birds on a screen it is first necessary to decide how many birds are to be shown on the screen and the amount of space each specimen will occupy—space being left if necessary for subsequent additions—for this purpose rough sketches are made on the screen indicating the position of the bird. In arranging the specimens a lineal or monotonous arrangement should be avoided and an attempt should be made to arrive at a free and harmonious picture of the screen as a whole. When its genera design has been completed the mounted birds are fixed to the screen so that changes in arrangement if necessary may be made. When this is completed the specimens are removed and the whole screen is well sand papered and then painted with three coats of flat oil paint. The colour is applied with an air brush—petrol is used as a medium. This ensures a fine even flat coat of colour. Divisions between families are indicated by fine strips of beading. Variety may be given to the exhibits by introducing individual painted backgrounds showing the environment of a particular species and by the introduction of nests, foliage, etc. The labels are held in metal holders screwed on to the screen and coloured in a tone similar to the background.

(*To be continued.*)

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON

REPORT NO. 46

ON A COLLECTION FROM TOUNGOO, BURMA

BY

T. B. FRY,

South Kensington Museum.

COLLECTION	No. 46.
LOCALITY	Toungoo District.
DATE	November 1926–February 1927.
COLLECTED BY	Mr. J. M. D. Mackenzie, I.F.S.

The collection made by Mr. Mackenzie in the District of Toungoo is valuable in that it supplements those made by him in Prome and Pegu, and serves to illustrate fairly well the fauna of the country north of those districts and adjoining the Shan States ; in fact the work done by him in these three districts covers a considerable area which was left untouched by the Mammal Survey. Although a good many animals known, or supposed to exist in Burma, as noted by Mrs. Lindsay when reviewing the survey work, have so far eluded capture, yet the general fauna of this country is fairly well known, and to this knowledge Mr. Mackenzie has contributed in no small measure.

The present collection represents 14 genera and 18 species none of which are actually new, but there are many specimens which were much wanted, notably *Tomeutes ph. phayrei.*

MACACA MULATTA, Zimm.

The Rhesus

(Synonymy in No. 16.)

Toungoo, ♀ 1.

Specimens of this monkey were included in the collections made in Prome and the Shan States respectively, by Messrs. Mackenzie and Shortridge, so that its existence in the intervening district of Toungoo was more than probable, still it is satisfactory that this has been proved. Blanford stated that this species was known throughout Upper Burma and as far south as Bombay in India proper. On the one hand no specimens were found in Tenasserim, Burmah, nor on the other in Dharwar, Kanara, etc., S. India, during the Mammal Survey operations consequently it may be inferred that this macaque has not wandered further south than about 18° N. latitude, and the limits of its habitat have now been fairly well established.

CYNOPTERUS BRACHYOTIS ANGULATUS, Mill.

The Malay Short-nosed Fruit Bat

(Synonymy in No. 17)

Toungoo, ♀ 1.

Corresponds in all respects with specimens from Tenasserim and the Mergui Archipelago.

SCOTOPHILUS CASTANEUS, Horsf.

The Chesnut Scotophil

(Synonymy in No. 17)

Toungoo, ♂ 2, ♀ 5.

Hitherto recorded only from the Malay Peninsula, Tenasserim and the Mergui Archipelago ; it is therefore noteworthy that it occurs so much further north.

Taphozous longimanus, Hardw.

The Long-armed Sheath-tailed Bat.

(Synonymy in No. 6)

Toungoo, ♂ 1, ♀ 2.

The male specimen differs considerably from the two females in colour being red instead of dark brown, but not in other respects. A similar variation has been observed in specimens from the Central Provinces.

Tupaia belangeri belangeri, Wagn.

The Burmese Tree Shrew

Toungoo, ♂ 1.

Specimens from Pegu and Prome were identified by Mr. Thomas as true *T. belangeri*, and this one tallies with them in fur and size of skull. It would appear that this species is confined to the above mentioned area since Mr. Thomas has separated into sub-species the animals found north and south of it, naming them respectively *T. bel. siccata* and *T. bel. tenaster.*

Viverra zibetha, Lin.

The Large Indian Civet

This specimen appears to be a true *zibetha*. Mr. Wroughton gave the names *V. z. picta* and *V. z. pruinosa* to specimens from Chindwin and the Shan States respectively, but they differ so slightly from *zibetha* that it is doubtful if they will ultimately be accepted as subspecies.

Paradoxurus birmanicus, Wr.

The Burmese Palm Civet

(Synonymy in No. 16)

Toungoo, ♂ 1.

A young specimen, but the black lines on the back by which it is distinguished from *P. niger*, are clearly marked.

Petaurista cineraceus, Blyth.

The Tenasserim Brown Flying Squirrel

(Synonymy in No. 29)

Toungoo, ♂ 1.

Blanford considered this Burmese Flying Squirrel to be identical with the very similar, though rather larger, animal *P. philippensis*, but this name is now held to apply to a southern Indian form. There are considerable differences in colour notably in the tails which are grey in *cineraceus* and black in *philippensis*. The Society is indebted to Mr. Mackenzie for three other specimens from Pegu and Prome, no others having been obtained by the Survey.

Ratufa gigantea, McCl.

The Assam Giant Squirrel

(Synonymy in No. 14)

20 miles N. of Toungoo, ♂ 1, ♀ 2.

Callosciurus ferrugineus, F. Cuv.

The Burmese Bay Squirrel

(Synonymy in No. 16)

25 miles N. of Toungoo, ♂ 1, ♀ 1.

Tomeutes phayrei phayrei, Blyth.

Phayre's Squirrel

(Synonymy in No. 14)

5	miles E.	of Toungoo,	♂ 1, ♀ 2.
7	,,	,,	♂ 3, ♀ 3.
40	,,	,,	♂ 1, ♀ 5.
30	,,	,,	♂ 2, ♀ 2.
15	,,	,,	♂ 1.
11	,,	,,	♂ 1.

No true specimens of *T. ph. phayrei* were obtained by the Survey; those recorded in Report No. 14, being subsequently recognized as *T. ph. blanfordi*. The former are more highly coloured above and below, while the dark stripes on the under sides are absent or much less accentuated in the latter.

TOMEUTES PYGERYTHRUS, Geoff.

The Irrawady Squirrel

(Synonymy in No. 29)

30 miles west of Toungoo, ♂ 2, ♀ 2.
20 ,, ,, ♂ 1.
40 ,, ,, ♂ 1, ♀ 5.

Variations in colour, from a bright olivaceous to a dull grey, are very noticeable in these specimens; this is due no doubt to slight local differences in environment (such as thick or open forest), as they were all taken within a comparatively few miles of each other.

TAMIOPS MACCLELLANDI, Blyth.

The Striped Burmese Squirrel

(Synonymy in No. 14)

5 and 7 miles E. of Toungoo—♀ 1 and ♂ 3.

Tamiops m. barbei was obtained from the Shan States, Prome, Mergui Archipelago and Tenasserim, thus indicating that Toungoo is probably about the southern limit to which *macclellandi* proper extends.

GUNOMYS VARIUS, Thos.

The Malay Mole Rat

(Synonymy in No. 17)

Toungoo, ♂ 1, ♀ 1.

It may perhaps be worth while to point out that Toungoo is the most northerly district from which *G. varius* has been recorded; but as this rodent may easily have been carried northward by river-boats, etc., up-country correspondents of the Society (if there are any) might be asked to keep a look out for it.

RATTUS CONCOLOR, Blyth.

The Little Burmese Rat

(Synonymy in No. 16)

20 miles north-west of Toungoo, ♂ 1.
Toungoo, ♂ 7, ♀ 3.

RATTUS RATTUS KHYENSIS, Hinton.

The Shan Tree Bat

(Synonymy in No. 1)

20 miles north-west of Toungoo, ♀ 1.

In the earlier reports all the common house-rats received from Burmah were recorded as *R. r. rufescens* variety white under parts.

RATTUS RATTUS RUFESCENS, Gray.

The Common Indian Rat

(Synonymy in No. 1)

Toungoo, ♀ 2.

CANNOMYS PATER, THOS.

The Bay Bamboo Rat

(Synonymy in No. 20)

25 miles N. of Toungoo, ♂ 2, ♀ 4.

These specimen are undoubtedly *C. pater*. Geographically they should belong to one or the other of the subspecies *C. c. plumbescens* or *C. pater*, made by Thomas, and the general colour clearly indicates that they should be classed as the latter.

A PRELIMINARY REPORT ON THE ANATOMY AND LIFE HISTORY OF THE COMMON EDIBLE BACKWATER OYSTER, *OSTREA MADRASENSIS*

(*A paper read before the Indian Science Congress, Lahore, January, 1927*).

BY

S. T. MOSES, M.A., F.Z.S., F.R.A.I.

(*With 2 plates*)

This backwater oyster, common in Madras Presidency in all estuaries and favoured spots along the coast, owes its widespread presence to its being generally unaffected by a long range of variation in the salinity of the water it lives in ; a sudden onset of fresh water, as during floods, however kills thousands annually. Being commoner than the fresh water mussel, it may with advantage be used as a type for dissection in the class room.

The anatomy of the Tuticorin backwater oyster was one of the earliest items of research I did for Mr. Hornell, and later I had opportunities to examine oysters from Pulicat, Ennur, Cochin, Cannanore and Calicut. In the plankton collections of these places I found occasionally the trochophore and veliger stages of the oyster. These notes are presented in this form not because they are complete but that others with greater facilities may fill up the gaps in them, e.g., among others, trace in the laboratory the complete life-history from the egg to the spat.

Mr. Hornell in 1909 believed this species to be identical with the Ceylon oyster identified as *Ostrea cucullata* and said it was closely akin to the American *O. virginica* and stated that the two seemed to be geographical races of one species. *O. cucullata* is, however, the rock oyster which is characterized by the deep ridges of the shell ending in dentate edges which interlocked tightly when the valves came together. In 1910, however, Mr. Hornell differentiated the Sind species with a white muscular scar, from ours which has a purplish-black scar, but said that both appeared to be related to the Portugese mud oyster *O. angulata*.

The Chilka Lake oyster once named *O. gryphoides* var *cuttackensis* is now called *O. virginiana* by Vredenburg who says all our backwater oysters present no difference to the American species. Hornell agreed with Vrendenburg in 1917. H. B. Preston, the expert in charge of the publication of the volumes on Mollusca in the 'Fauna of India' series, declared in 1916 the extremely variable backwater oyster of the East and West Coasts as *O. madrasensis*. The close similarity of our species with the American in its anatomy and life history may justify its being named *O. virginiana* var *madrasensis*.

External appearance.—Nothing can be seen externally except the hard shell the sharp ends of which cut the feet of coolies and others wading on oyster beds. The shell, white and flinty in appearance, is covered by a thin cuticle which when fresh is slimy to the touch on account of its being encrusted with muddy algal felting. Though slipper is the typical shape, variation is the rule, as oysters are of irregular growth habit the shape depending on age, overcrowding and other conditions of life.

The shell as in all Pseudo-lamellibranchs is inequivalve. The valves are united anteriorly by a dorsal hinge ligament which being elastic keeps the shell agape. The attached valve, the left, is bigger and more convex and gives lodgment to the whole body while the free right valve being flat functions as a lid.

The thickness of the shell also varies. Laminations and roughly concentric lines of growth are seen externally. The latter start from a swollen knob, the umbo, which as in other bivalves is the early shell. It is recognizable by its dark color. The left valve grows faster than the right.

The interior of the shell is like porcelain and white in color except for the muscle scar and some patches along the margins where it is purplish or purplish-black, with a touch of red.

When a piece of shell is broken off and the fracture examined there are seen the three usual layers, a thin outer horny cuticle, a thick—the thickness varies according to the varying number of strata forming it at different places in the same shell—layer composed of small columns of calcium carbonate set close together and a third thin layer containing purplish and brown pigments in some parts. It is the thick middle layer which is responsible for the reputation of oyster shell grit to cure hens of laying soft eggs.

Soft parts.—To examine the soft parts, the oyster should be opened gently taking care not to damage the delicate organs. To get specimens in a completely relaxed condition, they should be killed overnight in a weak solution of Chloral hydrate. Soaking in alcohol facilitates the dissection of nervous and other systems.

To open an oyster insert the point of a stout knife in the posterior margin at a point about midway in the length. Then gradually push the knife in helping this by slightly rocking the blade sideways. Then when the knife is far enough pushed in cut through the muscle and separate the free valve from the other.

The body thus exposed is seen to conform to the shape of the valve. It is coated by a mantle which as in all bivalves is divided into two flaps which enclose all the internal organs as if in a curtain. It secretes the shell. Its free edges, purplish or dirty brown in color, are fimbriated and bear two rows of very highly sensitive short tentacles. Healthy oysters, when gaping, respond at once to the slightest touch of the mantle edge with a needle by at once tightening the valves.

Anterior to the muscle lies the visceral mass made up mainly of the light colored reproductive organs and the dark digestive glands. The visceral mass of spent oysters is dark colored, which prejudices some, but wrongly, against using such oysters as food.

Digestive system :—Anterior to the gills and between them and the hinge are the two pairs of fleshy palps which enclose the oval mouth. Food particles are brought in currents set by the action of the ciliated gills and palps. The direction is easily seen by sprinkling powdered carmine in the gills of a freshly opened oyster. The mouth leads through a short œsophagus into a stomach with thick but translucent walls. The dark green liver around the stomach sends many ducts to it. From the stomach leads the intestine which bends on itself when at the end of the muscle on its ventral side and coming back near its starting point describes a circle round the stomach and goes out as the rectum to the dorsal side of the muscle, to open out by a funnel-shaped anus. The rectum does not as in the fresh water mussel, traverse the ventricle and so the way to the heart is not through the stomach here. A crystalline style—absent in spirit specimens—is seen in the first (pyloric) arm of the intestines. The walls of the intestine and rectum are double induplicated, as may also be seen from the imprimature on the fæces.

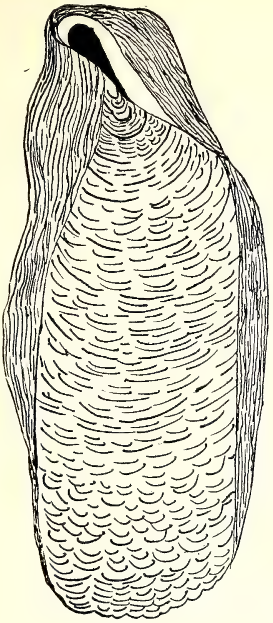
The food of the oyster is mainly diatomic and is found in the plankton of the water where it lives. About half the stomach contents consists of unrecognizable vegetable debris but the following were recognized :—Biddulphia, Rhizosolenia, Chætoceras, Coscinodiscus, Pleurosigma, Navicula, Ceratium, Foraminifera, Peridinians, Dinophysis, sponge spicules, setæ of Polychæt larvæ and Daphnids.

The enemies of the oyster are legion and they are active at all stages of its life. Apart from some, e.g., other molluscs, barnacles and aquatic flora, which crowd its beds to its disadvantage, there are active enemies like crabs (*Scylla serrata*), starfishes (*Luidia maculata* and *Astropectim*), shellfish (*Murex tenuispina*) and the boring sponge (*Clione vastifica*).

The oyster is edible, but Europeans who take it raw and in its natural juice should see that the source is not a sewage contaminated bed. The danger, though real, especially in a country where washing after evacuation is done anywhere, is exaggerated as oysters digest and kill injurious bacilli. Oysters however muddy their original habitat, become clean if placed for some days in a wholesome current and in fact in the Madras Aquarium clumps of live oysters when placed in tanks rendered the water less turbid and more crystal-clear. Once a dozen oysters from a suspected source as well as a dozen clean ones were sent to the King Institute, Guindy, for bacterial examination and both were declared free.

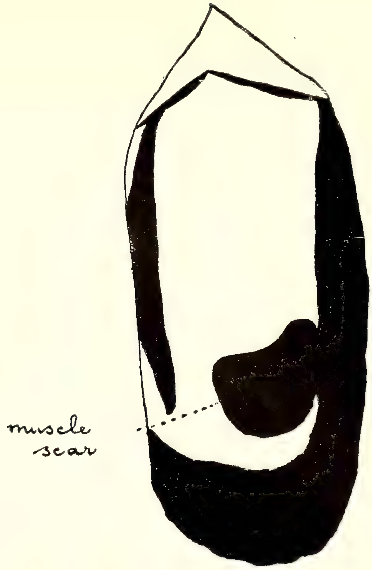
Vascular system.—Anterior to the muscle and between it and the visceral mass is a transparent thin-walled sac, the pericardium, containing the heart. There are two auricles and one ventricle. The ventricle does not, as in Lamellidens, embrace the rectum. To make out all the vessels, sections of hardened specimens are more satisfactory than dissection or even injection. The aorta after leaving the ventricle divides into two, one to supply the muscle and the other to the visceral mass. The blood from these organs go to the gills and after aeration flow into the auricles. The blood is colorless.

The gills.—Hanging down into the space between the two lobes of the mantle are two pairs of gills. Their ventral edges are free.



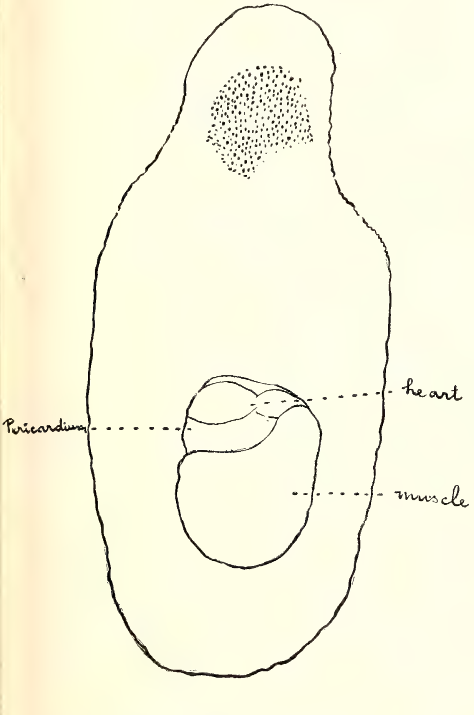
Ostrea madrasensis,
External view

I.


muscle
scar

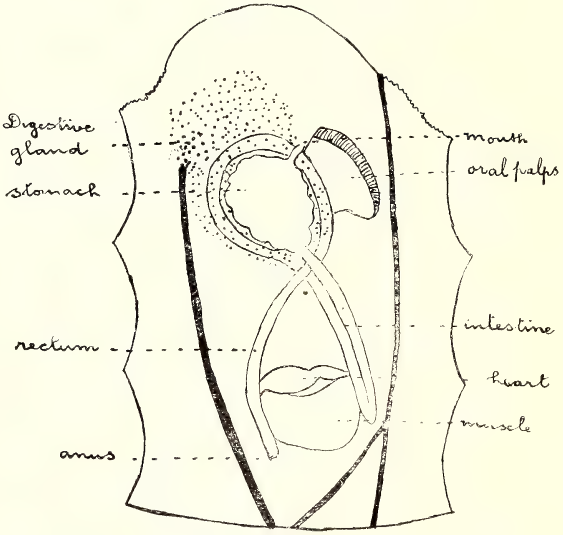
The free right Valve
under side.

ii


heart
Pericardium
muscle

The Soft parts
(Body)

iii

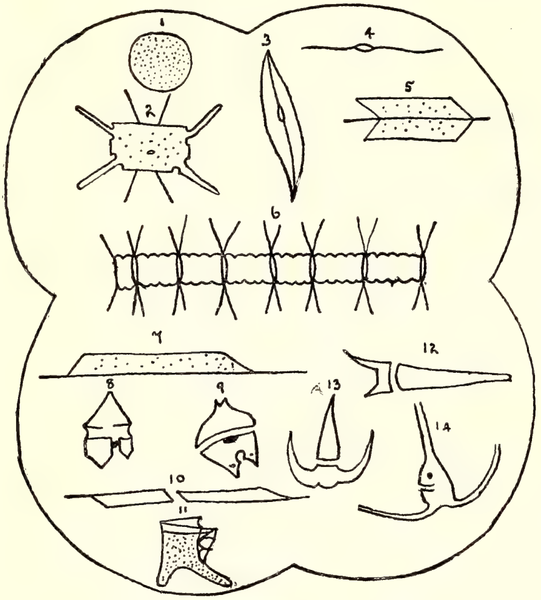

Digestive
gland
stomach
rectum
anus
mouth
oral palps
intestine
heart
muscle

Dissection
showing the alimentary System

iv

ANATOMY OF *Ostrea madrasensis*

1. Coscinodiscus
2. Biddulphia (granulata)
3. Navicula
4. Rhizosolenia
5. Biddulphia
6. Chaetoceras (crinitum)
7. Rhizosolenia
8. Peridinium
9. Peridinium
10. Rhizosolenia
11. Dinophysis (miles)
12. Ceratium (lineatum)
13. Ceratium (tripos)
14. Ceratium (trichoceras)


1
2
3
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5
6
7
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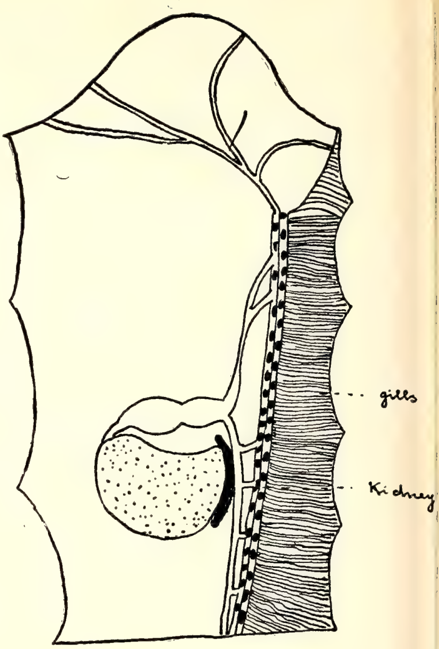
9
10
11
12
13
14

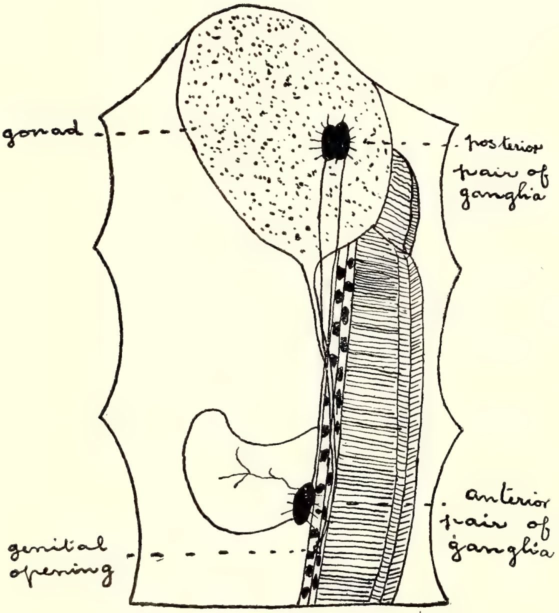
Stomach - contents

V


gills
Kidney

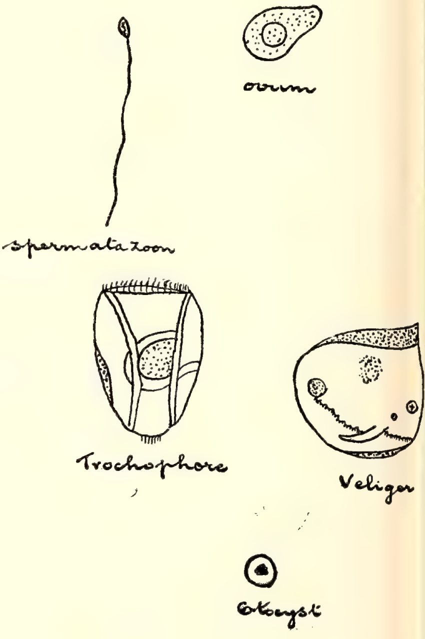
Dissection showing the Vascular & Renal systems

VI


gonad
posterior pair of ganglia
anterior pair of ganglia
genital opening

Dissection showing the Genital & Nervous systems

VII


ovum
spermatazoon
Trochophore
Veliger
Otocyst

VIII

ANATOMY OF *Ostrea madrasensis*

They are plaited and consist of a multitude of filaments closely covered with cilia. These cilia by their concerted action set the currents going; the stream of water aerates the blood as well as supplies food. The cilia also strain the food particles. The gills do not serve as a broodpouch unlike in the freshwater mussel though it does in another species *O. edulis* of Europe.

Muscular system.—The only muscle present in the adult is the posterior adductor, roughly rectangular with the dorsal side concave and stretching transversely across the body from valve to valve. The anterior of the two muscles present in the embryo atrophies later. The mantle has a radiating bundle of muscular fibres which withdraw the edge of the mantle from the margin of the shell and a set of fibres distributed lengthwise along the edge, which by contraction make it crinkled. The muscle fibres as in all bivalves are unstriped.

Excretory system.—The renal organs which are rudimentary, consist of a pair of simple tubes lined by secretory cells. One opening is into the pericardium while the other is into the mantle cavity, as in other Pelecypods.

Nervous system.—It is very simple consisting of two pairs of ganglia (aggregations of nerve-cells). The anterior pair have two commisures one on each side uniting them to the posterior pair lying below the muscle. The anterior pair innervate the internal organs while the mantle and muscles receive their nerve supply from the posterior.

The two rows of tentacles fringing the mantle are very sensitive and function as tactile organs. Eyes are absent though their function seems to be attended to by the marginal sense organs which react quickly even to a shadow flitting across the gape. Neither otocysts nor osphradia are seen but oysters do hear and detect changes in the salinity of the water. The veliger possesses an otocyst.

Reproductive system.—The fatness of an oyster lies in the fulness of the gonad which is found enveloping the visceral mass. The sexes are separate. If the milky fluid from the gonad be examined with a hand lens, that with particles present is the male's and the one without is the female's. The gonads are large paired glands and open out by ducts into the mantle cavity above the gills. When well developed they are swollen and enwrap the dark digestive glands—oysters are then very tasty to eat—the least pressure making the cream colored fluid exude. The ova and sperms pass out into the water through the mantle cavity and fertilization is external and accidental. The oyster spawns all the year round though two maximal seasons may be recognized, April to June and September to November. Sexual activity is stimulated usually by a reduction in the salinity and this depends on rainfall and sunshine.

The oyster passes through trochophore and veliger stages in its life-history. The veliger possesses a foot which is functional till the spat settles down to a fixed life. There is also an otocyst.

The growth after fixation is rapid, the oyster attaining a marketable size in 1½ years. The size attained within four months is remarkable but the shell is thin. The thickness and weight of the shell connote the age of the oyster better than its length and breadth. The largest examined was from the Pulicat Lake and the right valve measured 17″ by 7″.

Among curious places where spat settled down, were the two eyestalks of a thus blinded crab *Scylla serrata* from Pulicat Lake. The unfortunate crab had on its carapace many barnacles and on its gills Lepads identified as *Dichelaspis cor.*

ORNITHOLOGY IN THE BIBLE

BY

THE LATE LT.-COL. C.E. LUARD

Ah, the land of the rustling of wings,

Which is beyond the rivers of Ethiopia.

Before turning to the passages dealing with birds, a brief glance at the geography of the region involved will be useful. The area with which we are concerned is roughly Palestine, that is Cannaan and Syria and the neighbouring lands of Arabia, the Sinai Peninsula and more distant Egypt.

Dean Stanley in his charming *Sinai and Palestine* points out how the Peninsula of Sinai is remarkable for possessing the three grand features of earthly scenery, the sea, the desert and the mountains. The great desert area is, however, cut into by three great clefts, the Nile on the west, the Gulf of Suez in the centre and the Gulf of Akaba on the east, which last merges into the deep valley of the Arabah and yet deeper Jordan valley, further on. Palestine forms a high level tract lying between the plains of Assyria and the Mediterranean. Long before the war made it a reality, it was familiar to all of us of the older generation from very early days, as a land intimately connected with the absorption of tiresome chronological and historical minutiæ concerning an apparently very overrated people. From north to south a great limestone ridge, which splits into two parallel chains, traverses the whole country, while four rivers the Orontes, Litani (or Leontes), the Barada (Abana of the O.T.) and the Jordon flow through it. The last is the most important and is the main artery of Palestine. On either side of it run chains of mountains linking up with those of Sinai. Palestine is thus curiously isolated. On the east is a desert, in the centre the deep Jordon valley, a formidable trench, on the west the sea, on the south desert again and on the north the Lebanon range. So this small area, only some one hundred and forty miles long and sixty wide, offers variations in climate, soil and vegetation which make it an ideal place for animal life of all kinds. While the Jordon valley falls to 2,300 feet below sea-level, the mountains of Lebanon rise to over 2,000 feet above it, with snow-capped peaks. Thus snow-covered hills, deep and fertile valleys, dry hot winds from the deserts and cool sea breezes, offer unusual opportunities for bird life, through the various plant and insect life the area produces.

Palestine lies in the Holarctic region of Newton or Palaearctic of Sclater above the Ethiopian and Indian, and many bird forms common in India are met with, such as bulbuls, the white-breasted kingfisher, sun-birds, and many birds of prey.

The birds Moses encountered were probably much the same as those met with in this region to-day.

The birds mentioned in the Bible are not of course all those seen by the writers but only those which entered most into their daily lives either as beneficent or unkindly visitants, and those which were striking and useful in metaphor.

To the Israelites lying out on the slopes of Mount Hermon or watching their flocks and herds in the fertile plains, the birds of prey were of peculiar interest, and but too familiar and dreaded visitors. How often must the youthful David have watched

> " the eagle that swoopeth on the prey."

We may, therefore, take the birds of prey together as a conspicuous group. This is the more useful in that it is not always easy to say if an eagle, kite or vulture is referred to. But is this surprising? Take any five of your friends out and see how many birds they can distinguish even when not so closely connected as the birds of prey or so similar in habits and appearance, that save in their size and idiosyncracies of flight they offer no very distinctive signs.

I would here note that throughout this account the Revised Version (R.V.) is referred to unless the Authorized Version (A.V.) is especially noted.

The birds of prey mentioned are, eagles, the glede, falcons, gier-eagle, the kite, hawk, osprey, ossifrage and vulture. The owls may be dealt with separately.

The A.V. and the R.V. differ in the translation of the principal passage which mentions these birds. I may add that throughout this article I have quoted somewhat fully as many members of the Society may be unfamiliar with our Bible, while my own experience has proved how seldom my countrymen's houses contain a copy of the Revised Version.

The two passages lie in Leviticus and Deuteronomy and enumerate birds which were unclean and therefore not fit for food.

R. V.

Lev. 11-13, 17 :

> And these ye shall have in abomination among fowls ; they shall not be eaten, they are an abomination ; the eagle, and the gier-eagle, and the osprey ; and the kite, and the faclon after its kind ; every raven after its kind and the ostrich, and the night-hawk, and the sea-mew, and the hawk after its kind ; and the little owl, and the cormorant, and the great owl ; and the horned owl, and the pelican, and the vulture ; and the stork, the heron after its kind, and the hoopoe and the bat.

A.V. (*as given*)

> Eagle, and the ossifrage, and the osprey and the vulture, and the kite after his kind ; every raven after his kind ; and the owl, and the night-hawk, and the cuckow, and the hawk after his kind, and the little owl, and the cormorant, and the great owl, and the swan, and the pelican, and the gier-eagle, and the stork, the heron after her kind, and the lapwing and the bat.

The changes are those of gier-eagle for ossifrage, kite for vulture, falcon for kite, ostrich for owl, sea-mew for cuckow, horned owl for swan, vulture for gier-eagle and hoopoe for lapwing. The bat seems to have been looked upon as a bird.

In the corresponding passage in Deuteronomy (14-11) the lists run thus :

R.V.

Eagle, gier-eagle, osprey, glede, falcon, kite, raven, ostrich, night-hawk, little owl, great owl, horned owl, pelican, vulture, cormorant, stork, heron and hoopoe.

A.V.

Eagle, ossifrage, osprey, glede, kite, vulture, raven, owl, night-hawk, cuckow, hawk, little owl, great owl, swan, pelican, gier-eagle, cormorant, stork, heron and lapwing.

It should be borne in mind that the Hebrew word is of course the same in the A.V. and R.V., only the interpretation is new.

Birds of Prey

In his solitude and grief, and, be it added, the lecturing of his prosy but well-meaning friends, Job seems to have turned instinctively to nature.

Job 12-1 :

No doubt ye are the people,
And wisdom shall die with you.
I have understanding as well as you

. . . .

7. But ask now the beasts, and they shall teach thee ;
And the fowls of the air, and they shall teach thee ;
Or speak to the earth, and it shall teach thee.

Some of the finest passages on birds are his. In chapters 36 and 37 Elihu pours out his long-winded discourse naively commencing with

Suffer me a little and I will shew thee
For I have yet somewhat to say on God's behalf.

Until God, losing patience, speaks from the storm which has gathered as Elihu discoursed, and exclaims,

Who is he that darkeneth counsel by words without knowledge ?

and then asks Job who he is and of what account :

39-27 :

Doth the hawk soar by thy wisdom,
And stretch her wings toward the south ?
Doth the eagle mount up at thy command ?
And make her nest on high ?
  She dwelleth on the rock, and hath her lodging there,
  Upon the crag of the rock and the stronghold.
  From thence she spieth out the prey :
  Her eyes behold it afar off.
  Her young ones also suck up blood :
  And where the slain is, there is she.

Possibly here some confusion has arisen with kites or vultures but many eagles do eat carrion, at times. I have myself seen the Indian tawny eagle (*Aquila vindhiana*) sharing a dead cow with kites, vultures and dogs.

The passage is an astonishing summary of eagle life. The strength, swiftness and savage nature of these birds are constantly used in metaphor:

Job 9-25:

> Now my days are swifter than a post :
> They flee away, they see no good
> They are passed away as the swift ships :
> As the eagle that swoopeth on the prey.

The post is the 'harkara' of India, each man doing his section of a journey :

Jer. 51-31 :

> One post shall run to meet another.

Solomon used the eagle in metaphor :

Prov. 30-18 :

> There be three things which are too wonderful for me,
> Yea, four which I know not :
> The way of an eagle in the air,
> The way of a serpent on a rock,
> The way of a ship in the midst of the sea,
> And the way of a man with a maid.

Then there is that fine passage in Jeremiah, in chapter 4, where in verse 13 the swiftness of the eagle is referred to ; it is dramatic in form and for proper appreciation the speakers should be indicated:

Jer. 4-11 :

10. *Prophet.*

> Ah, Lord God ! Surely thou hast greatly deceived this people and Jerusalem, saying, 'Ye shall have peace'; whereas the sword reacheth unto the soul. And at that time shall it be said to this people and to Jerusalem.

A Cry :

> A hot wind from the bare heights in the wilderness toward the daughter of my people, not to fan, nor to cleanse.

The Lord :

> A full wind from these shall come for me : now will I also utter judgments against them. Behold, he shall come up as clouds and his chariots shall be as the whirlwind ; his horses swifter than eagles.

The People :

> Woe unto us for we are spoiled :

Here whirlwind, horse and swooping eagle are brought together as the swiftest things the writer knew.

In Habbakuk, which is really written throughout in dramatic form, though this is not brought out in our Bible, he refers to the approaching Chaldean attack. The Prophet cries to the Lord in verses 1–4 and in verses 5–10 ; the Lord replies :

V. 6. *The Lord :*

> For, lo, I raise up the Chaldeans that bitter and hasty nation, which march through the breadth of the earth to possess dwelling places which are not theirs. They are terrible and dreadful : their judgment and their dignity proceed from themselves. Their horses also are swifter than leopards, and are more fierce than evening wolves ; and their horsemen spread themselves : yea their horsemen come from far ; they fly as an eagle that hasteth to devour.

In some passages confusion between vultures and eagles can be clearly detected. Thus :
Micah. 8-16 :

> Make thee bald, and poll thee for the children of thy delight,
> Enlarge thy baldness as the eagle :
> For they are gone into captivity from thee.

No eagles are bald, whereas vultures often are. Probably the well-known passage in Matthew is another instance :
24-28 :

> Wheresoever the carcase is there will the eagles be gathered together.

In both cases the marginal reading is ' vultures.'

In the wonderful song sung by Moses in the 32nd chapter of Deuteronomy the eagle is used in metaphor :
Deut. 32-10, 11 :

> He found him in a desert land,
> And in the waste howling wilderness ;
> He compassed him about, he cared for him,
> He kept him as the apple of his eye :
> As an eagle that stirreth up her nest,
> That fluttereth over her young,
> He spread abroad his wings, he took them,
> He bare them on his pinions :

The A.V. has for the last line :

> taketh them, beareth them on his wings

apparently with the idea that an eagle carried its young in this way.

In that most wonderful of laments (quoted at the end of this article) David compares Saul and Jonathan to eagles (II Sam. 8-17).

Like Moses, Isaiah uses eagles in referring to God's care for Israel : and the freeing of God's servants :
Is. 40-28 :

> . . . the everlasting God, the Lord, the Creator of the ends of the earth, fainteth not neither is weary. . . . But they that wait upon the Lord shall renew their strength : they shall mount up with wings as eagles : they shall run and not be weary, they shall walk and not faint.

There are many other passages, which will be found in the index of references, but these are perhaps the most important.

Vultures are specifically referred to in certain passages, besides the marginal alternative readings mentioned.

The vulture is one of the unclean birds, but the R.V. has gier-eagle where the A.V. has vulture, and a marginal reading ' great vulture ' against ' eagle '. In the corresponding passage in Deuteronomy the R.V. has ' gier-eagle ' where the A.V. has ' ossifrage '.

The vulture was of course as familiar an object to the Israelite as it is to us in India.

The vulture occurs in no passages except in these lists, in the R. V. as in the two passages in the A. V. viz., Job 28-7 and Is. 34-15 we now have ' bird of prey ' in the first and ' kite ' in the second.

Without going into the question too closely it will be interesting to consider the basis on which these translations are founded, Generally the R.V. has accepted the premise that resemblance between the modern Arabic name and the early Hebrew word is a sure guide to identification of the bird.

The Hebrew word translated 'eagle' is 'nesher' from a root meaning 'to tear with the beak'. This corresponds with the Arabic word 'nasr' (نسر) with an identical meaning which though also used as a generic term, with qualifying adjectives for eagles, vultures, and ospreys, is usually applied to the Gryphon vultures (*Gyps fulvus*) and this is no doubt the bird meant. The passage in Mich. 1–16 where the word 'nesher' is used also shews this while the passages in Job 39-27, 30, Jer. 49-16 describe it well. The Assyrian vulture god, Nisroch, morever, was the Gryphon vulture, the marginal reading actually giving 'great vulture'. The Hebrew word 'rāchām' (Lev. 11-18; Deut. 14-17) is the same as the Arabic 'rakham' and 'rakhma' (رخمة) which the R.V. translates 'vulture' in place of the 'gier-eagle' of the A.V. The Arabic word designates the White Scavenger Vulture (*Neophron percnopterus*) a near relative of the 'Pharaoh's chicken' of our cantonments. The word 'vulture' is a translation of three Hebrew terms in the A. V., 'da-āh' (Lev. 11-14) and 'dayyah' or 'dayyoth' (Deut. 14-13; Is. 34-15). But in the R. V. it is rendered 'kite' in these places. The third term is 'ayyah' (Lev. 11-14; Deut. 14-13; Job 28-7) which the R. V. renders 'falcon'. The latter certainly means a small bird of prey and hence falcon is better 'hidayah' in Arabic is used of a kite. Possibly the 'daah' was the Red Kite (*Milvus regalis*) and 'ayyah' the black (*M. ater*).

The Gier-eagle or Ossifrage translates 'peres' (Lev. 11-13; Deut. 14-12) or 'the breaker'. The Lammageier or Bearded Vulture (*Gypætus barbatus*) was said to throw tortoises, etc., down from a height to break them, hence its name of 'bone-breaker'. The 'glede' (Deut. 14-13) may be a kite or hawk. The word is according to the *New Oxford Dictionary* used locally for buzzards, the osprey, and the peregrine, but more properly for the kite (*M. regalis*). The word is derived from a root meaning to 'glide'. The Hebrew word so translated is 'raah'.

The word 'hawk' translates the Hebrew 'nes' (Gen. 40-10; Lev. 11-16; Deut. 14-15; Job 39-26) and probably refers to the Kestrils, of which *T. chenchris* is commonest: but it may refer to the sparrow-hawk. But the term is generic for the smaller kinds of bird of prey. Some eighteen species of hawk have been recorded from Palestine.

A few passages deal with these birds:

Job 39-26:

> Doth the hawk soar by thy wisdom?
> And stretch her wings toward the south?

Is. 34-15:

> There shall the kites be gathered, every one with her mate.

It is thus clear that it is no easy matter to distinguish the different species from the words used.

In the New Testament in Matthew 24-28 and Luke 17-37 the word translated eagle is ‘ ætos ’ (αετος), though vultures are certainly meant. In Revelations 4-7, 12-14 eagles may be intended.

Falcons besides being in the lists of the unclean are mentioned in Job 28-7 where the A.V. has vulture. This last passage is very obscure in the A. V., whereas the R.V. clearly shows that a mine is being described, and well described :
Job 28, 1-11 :

Surely there is a mine for silver,
And a place for gold which they refine.
Iron is taken out of the earth,
And brass is molten out of the stone.
  Man setteth an end to darkness,
  And searcheth out to the furthest bound
  The stones of thick darkness and of the shadow of death.
  He breaketh open a shaft away from where men sojourn ;
    They are forgotten of the foot that passeth by ;
    They hang afar from men, they swing to and fro.
As for the earth out of it cometh bread ;
And underneath it is turned up as it were by fire.
The stones thereof are the place of sapphires,
And it hath dust of gold.
That path no bird of prey knoweth,
Neither hath the falcon's eye seen it :
The proud beasts have not trodden it,
Nor hath the fierce lion passed thereby.
He putteth forth his hand upon the flinty rock ;
His eye seeth every precious thing.
He bindeth the streams that they trickle not ;
And the thing that is hid bringeth he forth to light.

One is apt to regret that the keen-sighted ‘ vulture,’ as in the A.V., was not retained where we now have falcon.

Game Birds.—The only game birds mentioned are the partridge and the quail. It is curious that ducks are nowhere mentioned, although they must have been common enough even if they did not enter much into the life of the Jewish shepherd, and were perhaps not eaten. It has been suggested that the " fatted fowl," of I Kings 4-23, may be a duck or a goose, as the latter were fattened by the Egyptians.

Partridge is a translation of the Hebrew word ‘ qōrē,’ which occurs twice only, in I Sam. 26-20, Jer. 17-11. The Hebrew name is onomatopæic from the bird's call.

The ‘ partridge of the mountains ’

(I Sam. 26-20) is probably *Ammoperdix heyi* which is very common near the Dead Sea. It should, however, be noted that the Septuagint has, ‘ is come out to seek my life ’ where our Bible has ‘a flea ’. When hunted this bird conceals itself easily owing to its protective colouring. The other partridge met with is the Red-legged Chukor (*Caccabis chukor*) well known in India. Its cry is heard everywhere. The Arabic name for this bird is ‘ karia ’ (قارية).

The sandgrouse has been also suggested. In Eccus. 11-30 it is mentioned as being used as a decoy ; or possibly for fighting :

Like as a partridge taken and kept in a cage so is the heart of the proud.

Partridges are still used as decoys to catch Chukor.

The passage in Jeremiah has caused much comment: Jer. 17-11 :

> As the partridge that gathereth young which she hath not brought forth, so is he that getteth riches, and not by right ; in the midst of his days they shall leave him, and at his end he shall be a fool.

The words are spoken in a series of remarks not unlike proverbs. The passage may be corrupt as there is nothing known of this bird to lead one to suppose that partridge broods get mixed up.

Quail are first mentioned in Exodus 16-13 :

> And it came to pass at even that the quails came up, and covered the camp : and in the morning the dew lay round about the camp.

Num. 13- 31 :

> And there went forth a wind from the Lord, and brought quails from the sea, and let them fall by the camp, about a day's journey on this side, and a day's journey on the other side, round about the camp, and about two cubits above the face of the earth. And the people rose up all that day, and all the night and all the next day, and gathered the quails.

The same event is alluded to in Psalms 78-25 and 105-39 :

The birds were migrating and driven by the high wind to rest after crossing the sea. They come in March ordinarily in vast quantities. The Hebrew for quail (*Coturnix communis*) is 'selav' connected with a root meaning 'to be plump'. The Arabic word is similar, 'salwa' (سلوي). Sandgrouse have been suggested here also but so strong a flier would scarcely become exhausted in this way.

We may now pass on to birds of other classes. The words translated 'bird' are in the Old Testament four in number (i) '*oph*,'. rendered by bird or fowl, the latter generally described as 'of heaven' or 'of the air' (Gen. 1-21, 30 ; Lev. 1-14 ; Job 12-7 ; Ps. 50-11 ; etc.) ;

(ii) '*ayit*', rendered 'fowls' or 'birds of prey' in the A. V. and R.V. respectively (Gen. 15-11, 13 ; Job. 28-7 ; Is. 46-11 ; Ez. 39-4 ; etc.) ;

(iii) '*tsippor*', Arabic 'asfūr': (اصفور) is used of all small twittering birds (Gen. 7-14 ; Lev. 14-4 ; Ps. 102-8 ; etc.) ;

(iv) '*baal kanaph*' or 'possessor of a wing' (Pro. 1-17 ; Is. 10-14 ; etc.).

In the New Testament two words are used 'ta petaina' (*τά πετεινα*) see Mt. 13-4 ; Lk. 13-19 ; and ornea (*ορνεα*) for 'birds of prey' (Rev. 18-2 ; 19-17, 21).

Birds were not unsympathetically noted as we find their salient habits recorded. Migration is referred to, thus Isaiah evidently takes this metaphor from large migrating flocks, when he says :

Is. 31-15 :

> As birds flying so will the Lord of hosts protect Jerusalem.

Jer. 8-7 :

> Yea, the stork in the heaven knoweth her appointed times, and the turtle and the swallow and the crane observe the time of their coming ; but my people know not the ordinance of the Lord (*cf.* Cant. 2-12.)

Care of their young (Deut. 32-11 ; Mic. 23-37 ; etc.) their helplessness (Ps. 104-12). They were also tamed (James 3-7). Birds were used as food when clean and not in the prohibited list, quail, partridge, pigeons and doves are mentioned as eaten, while the Talmud gives a good deal of information on keeping birds for this purpose. The very poor eat sparrows (Mt. 10-29), while the eggs of clean birds were also used as food (Deut. 22-6; Is. 10-14 ; Lk. 11-12) The verse in Job is doubtful :

Job 6-6 :

> Can that which hath no savour be eaten without salt ?
> Or is there any taste in the white of an egg ?

The marginal reading ' purslain ' for the white of an egg is apparently correct and not as in the text.

Bittern.—This is one of those cases, not many, in which the Revisers seem to have gone astray. Where the A.V. has bittern the R. V. has porcupine. As will be seen below it endows the porcupine with vocal powers and an agility it certainly never possessed.

Is. 14-23 :

> For I will also make it (Babylon) a possession for the bittern and pools of water : and I will sweep it with the bosom of destruction.

A.V.

Zeph. 2-13 :

> And the flocks shall lie down in the midst of her (Nineveh), all the beasts of the nations both the cormorant and the bittern shall lodge in the upper lintels of it ; their voice shall sing in the windows. . . .

Is. 34-11 :

> But the cormorant and the bittern shall possess it ; the owl and the raven shall dwell in it. . . .

Whereas bitterns with their mysterious ' booming ' call, cormorants, ravens, and even the pelican, who takes the cormorant's place in the R.V., are suited to ruined places and pools of water and some of them can also perch, no porcupine ever climbed on to a ' chapiter ', as the R.V. has it, or sang in a window ! The Revisers took the Hebrew word ' quippod ' as porcupine owing to its resemblance to the Arabic ' kunfud ' (قنفد).

Cocks and hens.—Domestic fowls came into use, it appears, about 4 B.C. since all earlier representations are of wild fowl, as the drooping tail shows. The Old Testament nowhere mentions them but we meet with them in the New Testament (Lk. 13-34). The crowing of the cock is dramatically used in the well-known scene with Peter (Mt. 14-30) : this cock-crow was the third watch just before dawn.

Cormorant and Pelican.—The word ' qāath ' in Hebrew is translated cormorant in the A.V. but Pelican in the R.V. so that the cormorant in the R. V. is only mentioned in the lists of prohibited birds. The root of the Hebrew word means ' to vomit ' (Zeph. 2-14 ; Is. 22-11 ; 102-6). Actually the Pelician is not ' of the wilderness ' in the sense of desert as it is a water haunting bird.

Two species are common *P. onocrotalus* and *P. crispus*, the latter having curled feathers on its head.

The word translated cormorant in the R.V. is ‘ shālākh ’ that is a ‘ diver ’ (Lev. 11-17 ; Deut. 14-17). Its harsh cry is well known. There are two species *Phalacrocorax carbo* and *P. pygmæus.*

Crane and Swallow.—Translation has associated these very different birds, and the swift. The word ‘ sūs ’ or ‘ sīs ’(Is. 38-14 ; Jer. 8-6 ; Zac. 10-3 ; Ps. 32-9) is in the A. V. rendered by crane but in the R.V. by swallow. It should actually be swift. In the same passages the A.V. translates ‘ agūr ’ swallow and the R.V. crane.

Is. 38-14 :

> Like a swallow or a crane so did I chatter,
> I did mourn as a dove.

Jer. 8-7.

> . . . and the swallow and the crane observe the time of their coming.

In Psalm 84-3 ; 26-2 : it is the word ‘ derōr ’ that is translated rightly swallow : 84-3 :

> Yea, the sparrow hath found her an house,
> And the swallow a nest for herself, where she may lay her young,
> Even thine altars, O Lord of hosts, my King and my God.

These references are generally appropriate except that the term chatter is not very clear as though swallows might perhaps be said to chatter, cranes utter a more sonorous and trumpet-like note.

Cranes (*Grus communis*) are met with in winter in enormous numbers. Dean Stanley recounts how near Wadi Haderah the sky was literally darkened by a vast flight of red-legged cranes, with black and white wings. In the case of swifts and swallows in India one is familiar with their hordes building in temples and mosques.

Crow.—Not perhaps really distinguished from the raven. But it is only mentioned in the Apocrypha, in Baruch 6-54.

Cuckow and Sea-mew.—The Cuckoo (Lev. 11-16 : Deut. 14-15) has vanished from the R.V. giving place to the Sea-mew. The Hebrew word is ‘ shahaph.’ It was a water bird and may have been a gull. It is rightly placed in the list of the unclean which a cuckoo would not be.

Dove and Turtle-dove.—Words used in the Hebrew are three, and are not clearly distinguished as between doves and pigeons, which is not surprising seeing that modern ornithology cannot successfully differentiate between the two. The three words used in Hebrew for these birds are :—(i) ‘ *yonah* ’ (Lev. 5-7) which come from a root meaning to mourn and refers more to pigeons ; (ii) ‘ *tor* ’ meaning a turtle-dove (Lev. 12-6 ; Can. 2-12), an onomatopæic word representing its cry, and (iii) ‘ *gozal* ’ really the young of any bird, a ‘ cheeper ’ (Deut. 22-11) but also used for young pigeon (Gen. 15-9).

The first mention of the dove is in the story of the Flood (Gen. 8-8). Doves were evidently domesticated in early days. They were used for sacrifice as were also young pigeons (Gen.15-9). The brilliance of its colouring (Ps. 68-13), its harmlessness (Mt. 10-16), its helplessness (Ps. 74-19) are all referred to. It was used as a common name and as a term of affection (Cant. 1-15 ; 4-1 ; 5-2 ; 12 ; 6-9). It is also used as a type of the Holy Spirit (Mt. 3-16).

Dean Stanley describes how at Askalon the doves formerly sacred to Venus still inhabited the haunts of their ancestors, though the temple with its rites had long passed away. In a siege the dung of doves was eaten (I K 6-25).

Blue rock pigeons are met with in large flocks in the ' wadis ' or gorges : read pigeons for doves below :
Is. 60-8 :

> Who are these that fly as a cloud,
> And as the doves to their windows.

In Ps. 55-6 it should read (yonah) pigeons :

> And I said, Oh had I wings like a dove
>   Then would I fly away and be at rest.
> Lo, then would I wander far off,
>   I would lodge in the wilderness.
> I would haste me to a shelter
>   From the storm, wind and tempest.

The arrival of these birds is referred to also (Jer. 8-7 ; Can. 2-11, 12).

One of the turtle doves (*T. communis*) comes in April, another (*T. senegalensis*) roams the streets of towns half tame.

Fowl.—The word ' ayyit ' is translated ' fowl ' in the A.V. in certain places in which the R.V. has ' birds of prey ' (Gen. 15-11 ; Job 28-7 ; Ez. 39-17—birds) elsewhere fowl is retained.

Hoopoe and Lapwing.—The Lapwing of the A.V. has become Hoopoe (*Upupa epops*) in the R.V. The Hebrew word is ' dukipath ' (Lev. 11-19 ; Deut. 14-18). It is only mentioned among the unclean birds. The Hoopoe is a common spring visitor.

Heron.—This bird is only in the prohibited list (Lev. 9-19 ; Deut. 14-18). The R.V. has ' ibis ' as a marginal reading. Herons are abundant (*A. cinerea* and *A. purpurea*). The ibis consorts with herons.

Hunting.—It will not be out of place to make some reference to hunting. Hunting for sport is a product of comparatively advanced civilization. Man could not afford to hunt for sport so long as his food supply had to be obtained in the chase. Nimrod was not a hunter for sport, but a mighty slayer of noxious wild animals.

The hunter is noted as uncouth (Gen. 10-9) but cunning. Birds were hunted (Sam. 26-20) as the partridge, and according to the law they had to be bled, similarly to the ' halāl ' of the Musalman :
Lev. 17-13 :

> And whatsoever man there be of the house of Israel, or of the strangers that sojourn among them, which taketh in hunting any beast or fowl that may be eaten ; he shall pour out the blood thereof, and cover it with dust. (See Deut. 12-16).

Bows and arrows were used (Gen. 27-3 ; etc.) and these were at times of bronze or bronze mounted (Ps. 18-34 ; Job 20-24) the arrows were tipped with flints or iron. Slings were in common use, the tribe of Benjamin excelling in their use (Jud. 20-16 ; 1 Chr. 12-2).

Nets (*resbeth*—Prov. 1-17; Hos. 5-1) and snares or nooses (*moquesh*—Amos 3-5) are mentioned and clubs (Jer. 41-39).
Amos 3-5 :

> Can a bird fall in a snare upon the earth, where no gin is set for him ?

Ps. 69-20 :

> Let their table before them become a snare ;
> And when they are in peace, let it become a trap

Job 18-9 :

> A gin shall take him by the heel,
> And a snare shall lay hold on him.

The A.V. has 'robber' for snare.

The noose was used as also traps (Job 18-10). The fowler used such devices (Hos. 9-8). The word 'cage' in Jer. 5-27 should be 'trap'. Pits were used (Ez. 19-8). Decoys are mentioned (Eccus. 11-30).

Nests.—Many reference are made to nests, and a warning is given as to letting the parent birds go free (Deut. 22-6). Job refers to his house as his nest (Job 29-18). The Hebrew words is 'qen' (Gen. 6-14; Deut. 32-11 ; Nu. 24-21 ; Jer. 14-16 ; Hab. 2-9 ; Job 39-27).

Night-hawk.—The word rendered night-hawk is in Hebrew 'tĕchmās' which merely means a bird of prey being connected with a root 'to tear'. The night jar is in no sense a bird of prey and identification is, therefore, uncertain. The Septuagint and Vulgate translate it by owl (Lev. 11-16 ; Deut. 14-15).

Osprey.—The Osprey is only given in the prohibited lists in Leviticus and Deuteronomy, and is a translation of the Hebrew 'ozniyyāh'. It is unlikely to have been the osprey as there were no hunting grounds for it and probably it is another eagle or a harrier. The word osprey (Fr. *osfraie*) is itself merely a corruption of ossifraga, the name of the lammageier.

Ossifrage.—See birds of prey above.

Ostrich.—In the A.V. the Hebrew words 'bath yaanāh' (Lev. 11-16 ; Deut. 14-15 ; Job 30-29 ; Is. 13-21 ; 34-13 ; 43-20 ; Jer. 50-39 ; Mic. 1-8) are translated 'owl'. But the word means 'daughter of greed'. Two other words 'yeēnīm' (Lam. 4-3) and 'reanim' (Job 39-13) are translated owl and peacock in the A.V., but should be ostrich (*Struthio camelus*) which is met with in Barbary, Syria, Arabia and even Mesopotamia, while formerly it inhabited Egypt.

The ostrich has a very weird cry not, it is said, unlike a loud groan.
Mic. 1-8 :

> For this I will wail and howl ;
> I will go stripped and naked :
> I will make a wailing like the jackals,
> And a mourning like the ostriches.

Its preference for lonely spots is noted :
Job 30-29 :

> I am a brother to jackals
> And a companion to ostriches

Then Isaiah in describing the destruction of Edom cries:
Is. 34-13:

> And thorns shall come up in her places, nettles and thistles in the fortresses thereof; and it shall be an habitation of jackals, a court for ostriches.

In that great lecture on natural history which comes in the 29th Chapter of Job there is a dissertation on the ostrich:
Job 39-13:

> The wing of the ostrich rejoiceth;
> But are her pinions and feather kindly?
> For she leaveth her eggs on the earth,
> And warmeth them in the dust,
> And forgetteth that the foot may crush them,
> Or that the wild beast may trample them.
> She is hardened against her young ones, as if they were not hers,
> Though her labour be in vain, she is without fear;
> Because God hath deprived her of wisdom.
> Neither hath he imparted to her understanding.
> What time she lifteth up herself on high,
> She scorneth the horse and his rider.

The ostrich is too curious an instance of bird life not to attract attention, for a bird eight feet high which defends itself by kicking like a horse, has long eyelashes, only two toes and no wings to speak of, except ornamental plumes is an anomaly. The ostrich is polygamous, one cock having three or four hens. They lay in a common nest, a shallow pit scraped by their feet in the sand, which is heaped upon the sides as a protective wall. The cock begins the brooding as soon as a dozen eggs or so are laid, especially at night, by day their attendance is for watch and ward rather than hatching which is done by the sun's rays. The recognition of individual offspring by the mothers was thus not possible.

Owls.—The correction of owl to ostrich is given above. The words rendered owl are 'yansūph' (Lev. 11-17; Deut. 14-16; Is. 34-11), the 'great owl' but the Septuagint reads ibis: 'kos' (ib. and Ps. 102-6) little 'owl' and owl; 'tinshemeth' (Lev. 11-18; Deut. 14-16; Is. 34-11) is translated 'horned owl' in the R.V. but swan in the A.V. 'qippoz' (Is. 34-15) 'great owl' in A.V. and 'arrow-snake' in R.V. but as obviously a bird is meant the R.V. seems in error here; 'lilith' (Is. 34-14) in A.V. 'screech-owl' becomes 'nightmonster' in R.V. as in margin of A.V. Lilith is a fabulous monster, hairy and very fond of attacking infants, often appearing in female shape. Owls are very common in Palestine. *Athene glaux*, the 'bomeh', is very tame and a great favourite, *Otus ascalaphus*, etc.

Peacocks.—Mentioned in I. K. 10-22, 2 Chr. 9-21.

> Once every year came the navy of Tarshish bringing gold and silver, ivory and apes and peacocks.

The word is 'tūkkīyyim' and as the bird was not indigenous but imported the name is considered to be a corruption of the Tamil word for this bird, 'tokei'. The passage in Job 39-13 has ostrich in R.V. for the peacock of A.V., the Hebrew word being 'renānīm'.

Pelican.—See Cormorant.

Porcupine.—See Bittern.

Raven.—It was an unclean bird (Lev. 11-15; Deut. 14-14) and no doubt is not always distinguished from crows in the Bible. They are common in Palestine. The Hebrew word 'oreb' (Ar. Ghuráb) comes from a root meaning 'to be black', and hence includes all corvidae.

Sea-mew.—See Cuckow.

Speckled bird of prey.—This occurs in Jer. 12-9. The passage is:

> Is mine heritage unto me as a speckled bird of prey?
> Are the birds of prey against her round about?

It is not very clear what is meant except that birds of prey are inimical.

Stork.—The stork is among the unclean birds, but the crane is not (Lev. 11-19; Deut. 14-18, Job 39-13; Ps. 104-17; Jer. 8-7; Zac. 5-9). The Hebrew word is 'chasidah' meaning 'loving kindness. It is a useful bird in clearing caterpillars and locusts off the field', and is much prized in consequence, and nicknamed by the Arabs 'Am Said' or the 'Father of good luck'. It was hence sacred and is perhaps, therefore, mentioned to preserve it. The white stork (*Cicona alba*) is the commonest though the black variety (*C. nigra*) occurs.

Sparrow.—The word translated sparrow is 'tsippor' (Ps. 84-3; 102-7—fowl in A. V.) which means only a small twittering bird (Ar. asfūr (اصفور)). Small birds are not really distinguished and it is not possible to say what bird is actually intended. The 'sparrow on the house top' (Ps. 102-7) is possibly the *Petrocossyphus cyanea*, which is very common, its monotonous note being heard everywhere.

Swallow.—The Hebrew word 'deror' is rightly translated swallow. See Crane. Many varieties are met with, *H. rustica*, *C. urbica*, *Cotyle rupestris*, etc. Bee-eaters are possibly indicated by the same word.

Swan.—This bird has vanished from the R.V. in Lev. 11-18 and Deut. 14-16, and becomes 'horned owl' ('tinshemeth'). But probably the Ibis is meant or a coot; the vulgate has 'porphyrio'.

Before we leave the birds I would draw the attention of readers to the great beauty of many of the passages in which the birds occur. But it is essential, if their real beauty is to be seen, that they should be read in the R. V., or better still in Professor Moulton's 'Modern Readers Bible'.

It is probable that no worse edited book ever issued from a press than our Authorized Version, and it is a remarkable proof of our unquestioning acceptance of the established, that for some three hundred years we made no attempt to improve the form in which the greatest treasure of the English language was placed before us. As has been remarked, if Shakespeare, Bacon, Milton, Hallam, and Tennyson were issued under one cover, no distinction being made between prose and poetry, all titles being excised, the names of all speakers omitted, speeches divided in the middle and sentences cut up into a convenient length for a certain width of column, and the chapters formed of an equal number of obtrusively numbered verses, irrespective of sense or subject, such a work would scarcely be an exaggeration of our Authorized Version. The Revised

Version, much as it leaves to be desired, is a great improvement; especially in the distinction made between prose and verse. But to continue our subject.

These nomad open-air dwelling authors could scarcely have failed to be influenced by the poetry of bird life, and so we find it.

In that wonderful song of Moses in the 32nd Chapter of Deuteronomy which begins:

Give ear, ye heavens, and I will speak;
    And let the earth hear the words of my mouth;
My doctrine shall drop as the rain,
    My speech shall distil as the dew,
As the small rain upon the tender grass,
    And as the showers upon the herb.

and then he continues

V. 9:

For the Lord's portion is his people;
Jacob is the rock of his inheritance;
He found him in a desert land,
    And in the waste howling wilderness;
He compassed him about, he cared for him,
    He kept him as the apple of his eye;
As the eagle that stirreth up her nest,
    That fluttereth over her young,
He spread abroad his wings, he took them,
    He bare them on his pinions;

In the Song of Songs, that greatest of epithalamia, bird passages are frequent; but to get the full sense of this dramatic poem the speakers need to be indicated: the Bridegroom, the Bride, the King and the Choruses. In the second phase, in which the Bride is reciting the joys of courtship, we get a lovely spring song.

The Bride:

The voice of my beloved! Behold he cometh
    Leaping upon the mountains
    Skipping upon the hills.
My beloved is like a roe or a young hart
    Behold he standeth behind our wall,
He looketh in at the windows
He sheweth himself through the lattice.
    My beloved spake, and said unto me:
    'Rise up, my love, my fair one,
        And come away.
For, lo, the winter is passed
    The rain is over and gone
The flowers appear on the earth
    The time of the singing birds is come,
    And the voice of the turtle is heard in our land;
The fig tree ripeneth her green figs,
    And the vines are in blossom
    They give forth their fragrance
Arise, my love, my fair one
        And come away.
Oh my dove that art in the clefts of the rock,
    In the covert of the steep place,
Let me see thy countenance,
    Let me hear thy voice
For sweet is thy voice,
    And thy countenance is comely.

One is tempted to quote for ever and it should all be read, but read intelligently.

In the Psalms, bird passages are many. We may take one instance ; *Ps.* 91 :

> For he shall deliver thee from the snare of the fowler,
> And from the noisome pestilence,
> He shall cover thee with his pinions
> And under his wings shalt thou take refuge :

and again in Isaiah, who often uses bird metaphors : *Is.* 18 :

> Ah ! the land of the rustling of wings
> Which is beyond the rivers of Ethiopia ;
> That sendeth ambassadors by the sea,
> Even in vessels of papyrus upon the waters.

In Jeremiah. 4–23–26 ; in describing his vision of the destruction of the earth, he cries :

> I beheld the earth, and, lo, it was waste and void ; and the heavens and they had no light. I beheld the mountains, and, lo, they trembled, and all the hills moved to and fro. I beheld, and, lo, there was no man, and all the birds of the heaven were fled. I beheld, and, lo, the fruitful field was a wilderness, and all the cities thereof were broken down at the presence of the Lord, and before his fierce anger.

One more passage and I must leave it to my readers to search for themselves.

I will end with David's lament for Saul and Jonathan : 1 *Sam.* 31-19 :

> Thy glory, O, Israel.
> Is slain upon thy high places ?
> How are the mighty. . . .
> Fallen !
> Tell it not in Gath,
> Publish it not in the streets of Ashkelon ;
> Lest the daughters of the Philistines rejoice,
> Lest the daughters of the uncircumcized triumph.
> Ye mountains of Gilboa, let there be no dew nor rain upon you,
> Neither fields of offerings :
> For the shield of the mighty was vilely cast away.
> The shield of Saul, as of one not anointed with oils.
> From the blood of the slain
> From the feet of the mighty,
> The bow of Jonathan turned not back,
> And the sword of Saul returned not empty.
> Saul and Jonathan were lovely and pleasant in their lives,
> And in their death they were not divided
> They were swifter than eagles
> They were stronger than lions,
> Ye daughters of Israel :
> Weep over Saul,
> Who clothed you in scarlet delicately
> Who put ornaments of gold upon your apparel
> How are the mighty. . . .
> Fallen in the midst of the battle
> O, Jonathan,
> Slain upon thy high places
> I am distressed for thee, my brother Jonathan
> Very pleasant hast thou been unto me
> Thy love to me was wonderful,
> Passing the love of women.
> How are the mighty. . . .
> Fallen !
> And the weapons of war
> Perished.

So whatever the technical imperfections of the translation we should be thankful to the good fortune that gave us our Bible in the age of Shakespeare and remember the words of Jesus, the son of Sirach :—

> ' Ye are entreated therefore to read with favour and attention, and to pardon us if in any part of what we have laboured to interpret we may seem to have failed in some of the phrases. For things originally spoken in the Hebrew have not the same force in them when they are translated into another tongue.'

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Bird, *oph* : Gen. 1-21 ; 7-8, 14, etc. ; Lev. 17-13 ; 20-25, etc. ; Ps. 50-11, etc. (in general use).

ayit : Gen. 15-11 ; Is. 18-6 ; Job 28-7 ; Ez. 39-4.

tsippor : Gen. 7-14 ; 15-10 ; Ez. 17-23 ; Ps. 8-8 ; 11-1 (and many other places).

baal kanaph : Gen. 1-21 ; 7-14 ; Ps. 78-27 ; 148-10 ; Job 39-13 (and many other places).

Bittern (See *Porcupine*) : Is. 14-23 ; 34-11 ; Zep. 2-14. [so in A.V. only.]

Cage : Jer. 5-27 (better ' trap ').

Cocks (N. T. only) : Mt. 26-34, 74, 75 ; Mk. 13-35 ; 14-30, 68, 72 ; Lk. 12-34, 60, 61 ; Job 13-38, 18-27.

Cormorant, *shalākh* : Lev. 11-17 ; Deut. 14-17 ; Is. 34-11 ; Zep. 2-14 (see Pelican).

Crane, *agūr* : Is. 38-14 ; Jer. 8-7.

Crow (See *Raven*) : Baruch 6-54.

Cuckow (See *Sea-mew*).

Dove and Turtle-Dove, *yōnāh* : *tor* : *gozāl* : Gen. 8-8, 9, 11 ; 10-12 ; 15-9 ; Lev. 1-14 ; 5-7, 11 ; 12-6, 8 ; 14-22 , 30 ; 15-14, 29 ; 12-6 ; 14-22 ; Num. 6-10 ; Ps. 55-6 ; 68-13 ; 74-19 ; Cant. 1-15 ; 2-12, 14 ; 4-1 ; 5-2, 12 ; 6-9 ; Is. 38-14 ; 59-11 ; 60-8 ; Ez. 7-16 ; Nah. 2-7 ; Jer. 8-7 ; 48-28 ; Kos. 7-11 ; 11-11 ; Mat. 3-16 ; 10-16 ; 21-12 ; Mark. 1-10 ; Lk. 2-24 ; 3-22 ; In. 1-32 ; 2-14, 16.

Eagle, *nesher* : Ex, 19-4 ; Lev. 11-13 ; Deut. 14-12 ; 28-49 ; 32-11 ; 2 Sam. 1-23 ; Job, 9-26 ; 39-27 ; Ps. 103-5 ; Prov. 23-5 ; 30-17, 19 ; Is. 40-31 ; Jer. 4-13 ; 48-40 ; 49-16, 22 ; Lam. 4-19 ; Ez. 1-10 ; 10-14 ; 17-3, 7 ; Dan. 4-33 ; 7-4 ; Kos . 8-1 ; Obads 4 ; Mic. 1-16 ; Hab. 1-8 ; Mat. 24-28 ; Lk. 17-37 : Rev. 4-7 ; 12-14.

Falcon, *ayyah* (kite in A.V.) : Lev. 11-14 ; Deut. 14-13 ; Job 28-17 (Vulture in A.V.)

Fatted Fowl (Goose or Duck) : 1. K. 22.

Fowl (See Birds).

Fowler : Ps. 91-3 ; 124-7 ; Prov. 6-5 ; Jer. 5-26 ; Hos. 9-8.

Gier-Eagle, *peres* (Ossifrage in A. V.) : Lev. 11-13 ; Deut. 14-12.

Glede, *rahah* : Deut. 14-13.

Hawk, Lev. 11-16 ; Deut. 14-15.

Hen : Mt. 23-37 ; Lk. 13-34.

Heron, *anaphah* : Lev. 11-19 ; Deut. 14-18.
Hoopoe (Lapwing in A.V.) : Lev. 11-19 ; Deut. 14-18.
Hunting (See article) : Lev. 11-19 ; Deut. 14-18 : 1 Sam. 26-20.
Ibis (See Owl).
Kite, *da-ah* : Lev. 11-14 ; *dayyah* : Deut. 14-13.
Lapwing : (A. V.) (See Hoopoe).
Nest : Gen. 6-14 ; Num. 24-21 ; Deut. 22.6 ; 32-11 ; Job 29-18 ; 32-27 ; Ps. 84-3 ; 104-17 ; Prov. 27-8 ; Is. 10-14 ; 16-2; 34-15 ; Jer. 22–25 ; 42-28 ; 49-16 ; Ez. 31-6, 10-9 ; Ob. 4 ; Hab. 2-9 ; Mat. 8-20 ; Lk. 9-58.
Net (See Snares and Hunting).
Night-hawk, *tachmās* : Lev. 11-16 ; Deut. 14-15.
Osprey, *ōzniyyah* : Lev. 11-13 ; Deut. 14-12 .
Ossifrage (See Gier-eagle).
Ostrich, *bathya-anāh* : Lev. 11-16 ; Deut. 14-15 ; Job 30-29 ; Is. 13-21 ; 34-13 ; 43-21 ; Jer. 50-39 ; Micah 1-8 ; (A.V. has owl.) *ye-enim* ; La. 4-3 ; *reanim* : Job 39-13) A. V. has peacock).
Owl, *kos* : Lev. 11-17 ; Deut. 14-16 ; Ps. 102-6.
  quippoz : Is. 34-15. [Great Owl in A.V.] Arrow-snake of R.V. must be a bird.
  tinshemeth : Lev. 11-18 ; Deut. 14-16. [Swan in A.V., horned owl in R.V.]
  lilith : Is. 34-14 [Screech owl of A.V.], in R.V. is night Tonster.
  gansūph : Lev. 11-17 ; Deut. 14-16. In Is. 34-11 is probably the Ibis.
Peacock, *tūkkīyyīm* : 1. K. 10-22 ; 2. Chr. 9-21.
Partridge, *qore* : Is. 26-20 ; Jer. 17-11 ; Sam. 26-20 ; Eccus. 11-30.
Pelican, *qā-ath* : Lev. 11-18 ; Deut. 14-17 ; Ps. 102-6 ; Is. 34-11 Zep. 2-14.
Porcupine, *qippod* (Bittern of A.V.): Is. 14-23 ; 24-11 ; Zep. 2-14.
Quail, *selar* : Ex. 16-13 ; Num. 11-31 ; Ps. 106-409.
Raven, *oreb* : Gen. 8-7 ; Lev. 11-15 ; Deut. 14-14 ; I K. 17-4, 6 ; Job 38-41 ; Ps. 147-9 ; Prov. 30-17 ; Cant. 5-11 ; Is. 34-11; Lk. 12-24.
Sea-mew, *shachaph* : Lev. 11-18 ; Deut. 14-15.
Snares (See Hunting) : Ps. 91-3 ; 124-7 ; Prov. 7–23 ; Eccus. 9-12 ; Hos. 9-8 ; Amos 3-5.
Sparrow, *tsippor* (any twittering bird) : Lev. 14-4 ; Ps. 84-3 ; 102-7 ; Mat. 1029 ; Lk. 12-6.
Speckled Fowl : Gen. 12-9.
Stork, *chasīdah* : Lev. 11-19 ; Deut. 14-18 ; Job 39-13.
  flight of Ps. 104-17 ; Jer. 8-7 ; Zac. 5-8 ; 9.
Swallow, *derōr* : Ps. 84-3 ; Prov. 262 : Is. 38-14 ; Jer. 8-7 ; (see Crane).
Swan, *tinshemeth* (See Owl and Ibis) : Lev. 11-18 ; Deut. 14-16.
Turtledove, *tor* : Gen. 15-9 , Lev. 1-14 ; 5-7; 11 ; 12-6, 8; 14-22, 30 ; 15-14, 29 ; Num. 6-10 ; Ps. 74-19 ; Cant. 2-12 ; Jer. 8-7 ; Lk. 2-24.
Vulture, *rāchām* : Lev. 11-18; Deut. 14-17.

REVIEWS

1. ' STALKING BIG GAME WITH A CAMERA IN EQUATORIAL AFRICA with a Monograph on the African Elephant.' By Marius Maxwell. Royal quarto, 200 pp., 113 plates—London : William Heinemann, Ltd. 1925., Price, 52*s*. 6*d*. net.

Mr. Maxwell has done yeoman service in the cause of the Natural History of our larger game animals, and his book is virtually a plea for the protection of wild life from ruthless and wanton destruction and from the complete extermination with which a number of interesting forms are threatened in many parts of the African continent.

The modern camera as a weapon for hunting game is fast gaining in popularity with sportsmen all the world over, and this form of sport is one which certainly deserves all possible encouragement. We hope the day is not far off when it may supersede and completely replace the destructive rifle.

As the author points out, big game photography is an exhilerating sport and provides just as much healthy recreation—and we may add, after a perusal of his experiences, EXCITEMENT—somewhat more than the average sportsman bargains for—as the hunting of game with a rifle. Endless opportunities are at the same time presented to the observer who wishes to study at first hand the peculiarities of the larger creatures of the wilds commonly classed as dangerous. Much useful knowledge may be gleaned by the naturalist regarding the ways and habits of animals from photographs taken in their native surroundings and under perfectly natural conditions, and to the modern artist, sculptor and taxidermist such representations are invaluable for an accurate and truthful portrayal of his subject.

The major part of the book deals in a facile and lucid manner with the African elephant,—his ways, habits, gait, temperament and idiosyncracies. Chapter V on the Senses of the African Elephant is particularly thorough and illuminating and speaks much for the care and attention bestowed by the observer on the behaviour of his subject under varying conditions and circumstances, often extremely trying and uncomfortable. Supported as these observations are by a series of the finest photographs ever obtained of the pachyderm, they supply the most valuable first-hand knowledge we possess of these fast disappearing giants.

Excellent as have been the efforts of previous big game photographers, it is significant that neither Carl Schillings nor Radclyffe Dugmore appear to have been fortunate enough to succeed in photographing the African Elephant, probably on account of the nature of the country the animal frequents. Schillings with his telephoto outfit fully appreciated the difficulties involved, and indeed it is only the modern photographic apparatus equipped with the fastest of lenses that makes success possible in the gloomy ill-lit recesses of the bush country which is their home in daytime. Dugmore, moreover, chiefly employed fairly high power telephoto lenses which are wholly unsuited for instantaneous work in indifferent light. It is interesting to note that Mr. Maxwell advocates ordinary 3·5 to 4·5 (or faster) lenses with a focal length of 6 to 10 inches, such as he himself used, his plan being to stalk up carefully as close to his sitters as possible. He believes that real success with elephants lies only in the use of ordinary lenses at short range, as under the prevailing conditions these give more detailed and faithtul results that can be obtained from even telephoto lenses of low power. Maxwell's views as regards a suitable camera are apparently very different from Dugmore's who fourteen years ago (Camera Adventures in the African Wilds), considered that ' The ordinary little hand camera with its short focus lens is practically useless. Only once in a great while can one approach near enough to use it.' According to Dugmore the sort of camera necessary for the work is one of the long focus reflex type ' equipped with a convertible lens of high speed and a telephoto lens of the greatest speed. The camera must be rigid enough to allow the telephoto lens being used without danger of shaking.'

While acknowledging that both Schilling's and Dugmore's photographs are unique in their own way, and the latter's especially, as a whole, much sharper and better *as photographs*, it must be remembered that Maxwell's object in making his pictures was of a more specific nature. He deplored the absence of photographic illustrations in the epoch-making works of Selous and Neumann, and set himself out to fill the gap in the photographic records of the larger game animals of Africa by securing a series of photographs illustrating the life and habits of the African elephant in his native haunts, ***not*** by using such devices as camera-shelters, perches, flashlight or any other artificial means, but by stalking the animals and portraying them exactly as they are seen by the hunter of big game. The measure of his success can be readily gauged by any one who glances over his wonderful array of photographs.

The photographer's intrepidity leaves one agape. His experiences are recorded in a simple matter-of-fact manner and without garnish or exaggeration of the danger involved. In fact, the whole trend of Mr. Maxwell's writings is towards proving that the ferocity and truculence usually ascribed to even such admittedly dangerous creatures as the African buffalo are often much overdone, and that the natural tendency of wild animals is to leave man severely alone. His opinion about the disposition of the African elephant is that as a general rule, when not under severe provocation, he is a patient, retiring and even-tempered beast and by no means as savage as he is usually depicted. He admits however that ' Face to face meetings are at all times nasty incidents and particularly speculative at close quarters.' We like Mr. Maxwell's prescription of how to avoid the fury of a stampeding herd, and the advice is simple enough ; it would appear that the elephant accommodatingly possesses an instinctive aptitude for avoiding obstacles even in a stampede. Well, the thing to do the next time you find a herd bearing down on you is to stand behind the first thorn tree of average size you come across, restrain your natural inclination to bolt, quietly watch the rampaging monsters brushing past with intermittent deafening shrieks and shrill trumpetings, and safety is yours ! Unfortunately, however, ' There are of course exceptions to every rule ' !

One of the most remarkable pictures in the book, plate 5, Chapter III, is of a magnificent Masai bull elephant taken at a distance of approximately eight yards and under conditions that call for special mention. A face to face encounter with the African elephant growing in size at each advancing stride must be one of the finest and most impressive sights in nature, and, as the author says, ' To watch for the first time the reflected image of an advancing elephant with ears extended growing larger and larger on the focussing glass of a reflex camera is perhaps the strangest of possible experiences, and one that is not easily forgotten by the enthusiastic photographer.' This particular bull, on detecting the presence of the cameraman, deliberately moved forward towards him and when some eight yards from the lens suddenly stopped. Life and death hung in the balance. Suspense followed the click of the shutter. An eddy in the wind-currents might have changed the course of events and sent the animal either thundering down on the intruder or crashing through the bush in his haste to get away !

The chapters on Giraffe, Rhinoceros and Hippopotamus are excellent, and supported by a number of wonderful photographs. It is obvious that skilful tactics are required to stalk long-sighted giraffes in the open bush country which forms their usual habitat. The author has been able to secure a unique series depicting the gait of the animal over which there has been some controversy. His *modus operandi* was to pursue the animals in a Ford Car and to photograph them at close range with a short focus lens. Incidentally it is interesting to learn that for a distance of a couple of miles or so when driven to his utmost, a giraffe will keep up a speed of between 28 to 30 miles per hour and that even at this speed they appear to glide along without effort.

The most remarkable achievement with rhino, in our opinion, was when the author obtained four snapshots in succession of a charging rhino in various stages of the assault. The charge commenced at a distance of thirty yards, when the first picture was taken. Three others were subsequently obtained as the animal came on and was turned by a head shot from his companion's rifle, which covered the entire proceedings, and as the animal turned again and again to repeat the attack on its aggressors. Any one who has used a reflex camera will realize what a difficult proposition it is to change films, reset the shutter and make exposures in the face of such an onslaught and in circumstances which cannot but be exceedingly critical and trying.

The only grouse we have against Mr. Maxwell is that he omits to tell us what make of film packs he was using. In view of the excellent results he has obtained we think it was in fairness due to the makers of the film and to other enthusiastic photographers, whom the book may tempt to follow his lead, to divulge this very important secret of his success.

We cannot too strongly recommend every sportsman and naturalist to possess a copy of this book which will, we confidently believe, stand in a class by itself for many a long day.

S.A.A.

2. POPULAR ZOOLOGY (in Marathi). By Vishnu Narayan Gokhale, B.Ag. B.Sc. (Lecturer, Agricultural College, Poona) and Vasude. Ganesh Deshpande, B.Ag. (Lecturer, Agricultural College, Poona).

Teachers of Nature Study in the Marathi-speaking areas of the Bombay Presidency will welcome this volume. It deals thoroughly with animals of various types in language easily understood by school children. The printing is good. The drawings are numerous and excellent, and the size and price of the book are moderate. The authors are two of the junior staff of the Poona College of Agriculture and are to be congratulated on their very useful contribution to vernacular scientific literature. We trust that the book will have a large sale in the Marathi-speaking areas.

W.B.

3. 'A BIRD BOOK FOR THE POCKET.' By Edmund Sandars. (Oxford University Press. 7*s*. 6*d*. net.)

The little book that lies before us is of no importance from the point of view of scientific ornithology. The author in his preface admits the fact and expressly states that he does not claim to have added to existing knowledge. He has merely tried to make a handy pocket book in which a resumê of the chief facts in the life history of the ordinary British Birds is accompanied by ' a just picture of their beutiful forms and colouring '. We have therefore to judge the author's book merely in the light of the success with which he has attained his own objective. The illustrations are certainly no just picture of beauty of form or colouring. With scarcely an exception the shape, attitude and drawing of the birds is faulty while the colouring is crude and poorly reproduced.

The text is rather better. The short space of half a page allotted to most species is used to the best advantage with short crisp word pictures of the salient features of the bird's life, habits and characteristics. These are well expressed and accurate, though they tend to become mechanical and do not rise to special cases. For instance neither illustration nor text would help a beginner to differentiate between Willow-Wren and Chiffchaff except by their songs. Ten pages are given to a general introduction which describes briefly the leading characteristics of birds. This is helpful though it is disfigured by mistakes. For instance under the head of moult, currency is given to the mistaken belief in change of colour without a moult by a change of pigment in feathers ; while the statement that a stock-dove usually makes a hole in which to build its nest, and that the ' the Bearded Tit and the Game Birds are scratchers of the ground ' are samples of inaccuracies that spoil the introduction.

Finally there is a general chapter on eggs with indifferent coloured illustrations of a few general types. The index omits the scientific names but gives English and local names and a glossary of such words as seem to need explanation.

The idea and design of the book are very useful, but the execution might well have been improved upon.

H.W.

4. 'TIGER AND OTHER GAME ' BY COL. A. E. STEWART. London : Longmans, Green & Co. Ltd., 1927.

An excellent book. This and Dunbar Brander's are the two best books I have read. The way in which the book has been written and the variety of information and advice given by the author makes the work one of the most useful a novice on shikar could have. Col. Stewart devotes Chapter I to what he calls ' Preliminaries ' and in this very sound advice is given on points of etiquette and politeness in correspondence with Government Officials on the proposed shoot and in dealings with the local Forest Officers and village Headmen, etc. The first portion of Chapter II also deals with this, and excellent advice is given on the proper way of treating a jungle native, and the author is quite correct in saying that it is here that many soldier shikaries fail badly. The author has taken great pains to explain the whole procedure and methods to be adopted in beating for tiger and in sitting up for them. I notice that Col. Stewart takes an opposite view to General Wardrop with regard to following up wounded tiger. Col. Stewart considers that a tracker or two should go in front covered by the sportsman with his rifle at the ready; General Wardrop holds that the sportsman should be the one to go in front. I entirely side with Col. Stewart in this matter and agree with his methods. In his chapter on sitting up for tiger the author writes that a tiger when hit, if not knocked out, will usually charge in the direction he is facing and that a sportsman must have a clear view and steady aim if firing at a tiger facing him. As the book has been written, I take it, principally as a guide to inexperienced shikaries I think perhaps that the author might have said that on no account should a young shikari fire at a tiger facing him, but that he should get his sight on to him and wait till he starts to move off before firing. It is hardly likely that a novice on a tiger shoot would be absolutely steady in his aim, perhaps seeing his first tiger facing him, and a frontal shot in this case might be disastrous. I am glad that Col. Stewart is not one of those who absolutely ban the use of electric light when sitting up at night over a kill. In many parts of India, especially in the South, and where beating is impracticable, the use of artificial light is absolutely necessary.

Referring to the Sloth Bear the author remarks that it is a poor climber. Though I have never heard of a man being dragged out of a tree by a Sloth Bear I should hardly describe it as a poor climber. On the contrary I should say that the Sloth Bear is an exceedingly good climber and the height they will climb up a tree for figs and fruit is amazing.

Dealing with Bison the author writes that a tiger will think twice before he will tackle a Bison. I should say *Bull Bison* for I have known several cases of cows being killed, and three cases of Solitary Bulls being killed by Tiger, but I must admit that a tiger that can tackle and kill a Solitary Bull must be a large and powerful specimen.

I read the author's paragraph on sitting up over a wallow for observation with interest and pleasure, for this is what I enjoy doing exceedingly myself. If one has a permanent machan erected on a tree over a swamp or wallow the game get used to it and it attracts no attention whatever.

Writing on Grey Jungle Fowl the author remarks that he has never heard them calling on the ground and that he does not think they do. He is however quite mistaken here. Jungle Cock very often call on the ground during the daytime.

In his para on Taxidermists I think that the author's advice would have been better if he had said that heads and skins should be sent to the Bombay Natural History Society, Bombay, who undertake taxidermy work for its members, the standard of this work being equal to that produced anywhere, or to Messrs. Van Ingen and Van Ingen, or Messrs. Theobald Bros., both of Mysore. The Bombay Natural History Society employ the very latest methods and pay great attention to details. Living in Southern India I personally deal with Messrs. Van Ingen and Van Ingen and have always found them satisfactory, they are a most up-to date and skilled firm, and it can be truthfully said that the Bombay Natural History Society and this firm turn out work equal to, if not better than taxidermists at home. This being so I see no reason for sportsmen to send their trophies home, especially as the author admits that duty has to be paid on the trophies if they are brought out again.

There is one excellent preservative which I see the author does not mention for preserving skins and that is Atlas 'S'. I think there is nothing like it for putting on skins if the animal is freshly skinned, to keep them in good condition in hot jungles. This preservative is now used by the chief taxidermists and tanneries in India.

The author's advice on rifles and ammunition is very sound indeed, as also is his advice always to have a medicine chest in camp.

The Autobiography of Shaitan Bhalu and the illustrated interviews are very good indeed and form a happily thought-out ending to a book which is full of sound advice, useful information, and interesting anecdotes written in a plain convincing style from start to finish.

This book should be in the library of every sportsman.

R. C. M.

EDITORIAL

In the last issue of the Journal we published the proposed **new constitution of the Society** and we invited criticism and in fact printed at the end of the Bye-laws a slip which would enable members with very little trouble to themselves to advise the Honorary Secretary what their opinion on the subject is.

Members will no doubt be anxious to know what the general opinion is—we are sorry to say the general opinion of members is 'You can govern the Society as you like, personally we do not care the value of the smallest Turkish coin.'

Apathy—is it a tribute to the Committee? There has not been a single objection. All who have sent in their forms have approved, but 'all' is unfortunately not a word here which is an embracing one. It certainly does not embrace 'all' the members of the Society but embraces a minute number. The vast majority do not care.

If this attitude of the members towards the future constitution of the Society be an expression of confidence in the Committee, the Committee accept it but hardly with gratitude. They would be more grateful if members took an interest in what was going on; without interest being taken the Society is hardly likely to flourish.

Anyhow the response is sufficient to enable the Committee to go forward with the scheme and we hope by the time the next Journal is issued, to be able to announce that the Society is a registered Society and able to hold property and Government Paper in its own name.

The new constitution necessitates a close investigation of our **invested securities**—Do our investments equal the amount paid by living life members or are they too small or are they in excess? The Treasurer's Statement of Accounts should be in the next Journal, and will explain the actual financial situation of the Society better than ever before. The monies invested in, and derived from, the publications of the Society other than the Journal, and the income and expenditure of the Taxidermy Department will be separated from the regular income and expenditure of the Society under which head, as regards expenditure, will be taken expenditure which refers to every member of the Society—the issue of the Journal and the maintenance of the Society's Office staff, office and library. Without wishing to anticipate the Treasurer we can state here that our investments more than equal the amount contributed by living life members.

A question arises—if there be a surplus can that surplus be applied to any object the furtherance of which lies within the constitution of the Society, and if so, what would be the most pressing needs of the Society?

The most pressing need is a better illustrated Journal and perhaps the encouragement by a modest honorarium of those who write about Natural History subjects in a manner which appeals to the general member. The **Journal** must be our main recruiter and our binding link, but we want something more and we want a **good museum**—a museum for the student and research worker as well as a museum for the general public.

The arrangement the Society entered into, now several years ago, with the Bombay Government and the Trustees of the Prince of Wales' Museum, Bombay, has given members of the Society vastly improved conditions on those of old—though it was the personal care bestowed on the old museum that laid the foundations and enabled the superstructure to be erected. But no one will pretend that the existing building is suitable for a Natural History Museum nor that the accommodation provided is anything like sufficient for present needs. Members will be glad to know therefore that there is a possibility of the Trustees of the Prince of Wales' Museum being able to provide a **new building** for the needs of the Natural History Museum, and that the building, while in keeping with the noble architectural design of the late Mr. G. Whittett, will be one designed solely for the purpose for which it is intended to be used, namely a museum for the instruction of the public by the display of Natural History subjects in scenery characteristic of that in which the fauna exhibited lives and has its being. For this we shall have to thank not only the Trustees and the Architect, but the man who went to America and Europe and learnt what a revolution in museum methods had taken place, and having digested what he had learnt, proceeded, after the manner of many good mothers, to give of the digested learning to the young around him.

The Trustees of the Prince of Wales' Museum will however experience difficulty in finding the money for the actual building, and the whole scheme may be held up unless some wealthy citizen of Bombay or resident in India comes forward with a generous donation to the building fund as did the first Sir Currimbhoy Ebrahim, Bart., for the existing museum. The fitting up of the museum when built must, however, be the work of the Society and here we may find the best use for surplus investments—always provided of course that the membership is sufficiently large to enable us to carry on the ordinary work of the Society without needing the interest derived from surplus investments.

Whatever this surplus may be, it will be but a drop in the ocean compared with what we need and we record therefore with great pleasure the appointment of **Sir David Ezra, Kt.,** as a Vice-Patron of our Society. Sir David is a citizen of Calcutta who has done much for the Calcutta Zoo and for the Zoological Gardens at Regents Park. It was Sir David who provided the funds for the despatch to Bombay of the Elephant for the London Zoo which the British India Steam Navigation Company so kindly took home free, and Sir Ezra's donation of Rs. 5,000 towards the furtherance of the Society's work is not only opportune and needed but of good omen.

We cannot say when this new building will be available but we are already planning **habitat groups**—groups which will enable the observer to realize what the animal, bird, insect or reptile is like in its natural surroundings, and we are already in possession of promises of support from members who are able to get us suitable trophies.

We welcome, and we aid, in the cause of Natural History those who come to India and Burma on behalf of Museums situated in countries outside the Empire; we realize that we shall benefit by studying their methods but why—why—should the British Empire be left out of it? Are we to rest content with the fact that if we want to see a good and representative exhibit of the fauna of the Indian Empire we must go to America to see it? It rather looks like it. The wild fauna of a country under modern conditions has no certainty of continual existence. In what museums are there specimens of the almost extinct Smaller One-horned Rhinoceros (*Rhinoceros sondaicus*) of the Sundarbands, Tenasserim, and the Malay Peninsula? We know of none where mounted specimens exist but there soon will be in America, thanks to the **forthcoming expedition of Col. Faunthorpe and Mr. Vernay.** We hope that someone connected with our Museum will be able to accompany these gentlemen or their Artist Assistants, and if so, we look forward to the publication of an interesting account of modern methods in the collecting field.

Our editorial in the last number of the Journal on **Game Preservation** has produced a certain amount of criticism—not as much as we should have liked in view of the great importance of the subject. Some of the criticism has been adverse owing to the non-realization of the fact that in making out a case for Game Preservation it was necessary to look at the question from all sides, and an article such as we have written would have been incomplete without some reference to the economic or, as we said, more 'material motives' for the protection of Game. The plea for protection of Big Game *per se* would not necessarily carry the same weight with all classes of people.

The word 'Game' as considered in the framing of laws does not limit itself to the class of animals usually sought after by the shikari but includes wild life as a whole and would include the smaller carnivora which are hunted and trapped for furs and which would equally require protection if they are at all to be considered as an economic asset and they are seriously so considered in other parts of the world but always in regions where they do not clash with agricultural interests. We have stressed this point in our article where we definitely state that the plea for protection cannot carry weight in urban lands and cultivated areas. Our whole plea for protection is concentrated on waste lands and in forest areas, where the interests of man are not brought into conflict with the wild species and there are sufficiently large areas in India where these conditions prevail, which areas provide for the present the strongest guarantee against the extermination of wild life. The article was based mainly on correspondence received from members of the Society and was hence restricted in the main to such provinces from which information was available. We do not for a moment claim that it covers the question completely or is free from defects, but its purpose is to rouse interest and draw attention to a question which should be the concern of a Society such as ours.

We welcome all sane efforts to preserve the wild fauna of a country and in our next issue we shall refer once more to the work of the Society for the Preservation of the Fauna of the Empire with whom we intend affiliating.

In the present issue of the Journal we publish a review of Marius Maxwell's Book *Stalking Big Game with a Camera in Equatorial Africa.* A prospectus of Mr. Maxwell's book was forwarded to members with the October issue of the Journal and in the present number we have the pleasure of giving our readers a closer acquaintance with the author through the medium of his very interesting paper on 'The Home of the Eastern Gorilla'. Those who have seen Mr. Maxwell's book or have the good fortune to possess a copy, will realize that his magnificent series of portraits of African animal life require no commendation from us. The astonishing success achieved by the author led us to hope that someone would write the story of the Indian jungle as it never has been written before, in pictures of equal beauty and merit. Mr. F. W. Champion's book *With a Camera in Tiger-Land* fulfils this hope. Mr. Champion has done for India what Marius Maxwell, Dugmore, Schillings and others have done for Africa. He gives us intimate pictures of Indian animals in a setting which carries with it the spirit of the Indian jungle more effectively than pages of the printed word could have done. To those who love the Indan jungles—be they those to whom its sights and sounds are now but a happy memory or be they those who can still answer its call—we most heartily commend Mr. Maxwell's book and to the lucky latter we would add 'Go thou and do likewise'. The camera is increasingly becoming a competitor to the rifle in the hunting of game. **Hunting with a camera** has been rightly described as the expression of sport in its highest form. It requires all the qualities of hardihood, of daring and resourcefulness, of patient endurance and unflinching determination which are demanded from the ordinary hunter. Five years of continuous effort, Mr. Champion admits, have failed to produce for him a satisfactory picture of so common an animal as the Indian Sambhar although he has stalked to within a few yards of these magnificent creatures and could have shot a score of them in the same time. Hunting with the camera does not have destruction as its aim; it offers instead endless opportunities for the study, and enjoyable observation of wild life. It is no part of the camera hunter's business to frighten and disturb his quarry, and the trophies he obtains are far more interesting than any that could have fallen to his gun. The value and importance of his work in the faithful portraiture of animal life in its natural setting must increase as the inexorable march of civilization threatens, and will increasingly continue to threaten, wild life even in its uttermost retreat.

It is but too readily apparent, even to one only casually interested in the bird life of this country, how infinitismal is our present knowledge of **Bird migration in India** and how negligible have been our endeavours so far to further it, as compared with the efforts being made and the results achieved in Europe and America. No *systematic* effort has so far been made towards acquiring first-hand information regarding the movements of the hundreds of species that visit us year after year, the influx commencing about September-October and the exodus in March-April.

Individual observation is solely responsible for what little has been attained. Such observation deserves every encouragement and, in spite of the difficulties and shortcomings it presents, it is a mistake to underrate the value of such information obtained by careful study. An accurate record of the appearance and disappearance of a given species in any particular locality is manifestly of great value especially if the records for that locality extended over a number of seasons. By a systematic co-ordination of frequent and accurate notes of this nature it is often possible to learn something of the movements of migratory birds even though it is but very occasionally possible to see anything of the migration in progress, and, unless it be on some isolated island on the route taken by birds, preferably with a lighthouse, as for instance Heligoland or Fair Isle (between the Orkney and Shetland group) it is extremely difficult for individual observation to obtain direct evidence of migration; on the main land, with its large and varied native population of birds, such a method can at best yield very patchy results.

As distinct from the purely observational methods of study, which can clearly be pursued only by a very few observers who are fortunate enough to be stationed in favourable localities, there is the modern method of bird-marking. The 'ringing' of birds consists of the fastening of a light aluminium ring of appropriate size bearing a stamped number and address, on the instep region or 'shanks' of trapped or netted birds. The birds are then released.

A small percentage of these 'ringed' birds are afterwards shot or recaptured in distant parts of the globe and the rings are returned to the marking station with data as to the exact locality and date of capture. When a large number of such records have been collected and correlated, it is possible gradually to build up knowledge of the routes followed in migration, and a number of other important facts also which could not have been ascertained by other means.

As an instance it may be cited that rings put on Storks in North Germany have been returned from Damascus, Alexandria, the Blue Nine, the Kalahari Desert, Basutoland and elsewhere, so that Dr. Thienemann, the Director of the German Ornithological Society's observation station at Rossitten on the Baltic Coast (E. Prussia), was able to conclude definitely that there is an autumnal migration of Storks from the shores of the Baltic to South Africa.

Some of the main problems whose solution we in India may in course of time look for to this method of marking are:—

(1) To what extent do our migrants return to their birthplaces to breed and under what circumstances are new areas colonized?

(2) Do birds take up definite quarters when visiting this country, and if so, do they seek the same year after year?

(3) To what extent do the birds of a single species occupying the same area during their winter visit, seek the same area for breeding in the northern part of their range?

(4) Are definite routes followed by birds, and if so what are they, and what is the nature of such routes (i.e. course of a river, etc.).

There are besides a great many other questions that need answering, and little can be achieved unless there is a general realization of the fact that our knowledge on any of the above heads is practically nil, and unless a properly organized and systematic effort is made on an extensive scale for the capture, marking and release of our migrants throughout the country. It will be recalled that possibly the only experiment of this kind in India was carried out early in 1926 by the late Maharaja of Dhar, an ardent sportsman and naturalist. The results of this experiment were published in the Journal (p. 1034 of vol. xxxi) and a further recovery—the most interesting of the lot—was recorded on p. 222 of vol. xxxii. The results must be regarded as highly gratifying and indicate the scope and utility of the ringing method.

The Society proposes shortly (provided sufficient encouragement is forthcoming) to launch on a campaign of bird marking, and we trust that all bird lovers and members who have opportunities will come forward and co-operate with us whole-heartedly. We propose to issue to members on request at a nominal cost, aluminium stamped rings bearing a number and the Society's address, to be fastened round the legs of birds. Perhaps a beginning could conveniently be made with waterfowl.

Along with the rings, a schedule will be supplied to the member on which data about all birds marked will have to be filled in by him such as (1) number on ring, (2) species of bird, (3) date of marking and release, (4) locality of marking and release and (5) sex and other remarks.

The completed schedules when returned to us will be posted up in a special ledger. Any recoveries recorded will be entered up, and the marker immediately informed.

We look to our sporting princes, District Officers and other members who may be favourably stationed to co-operate in building up the much-needed knowledge regarding the movements of our birds. All interested in the scheme are cordially invited to communicate with the Honorary Secretary. Though the time is short let us hope a few thousand birds will have been ringed before the exodus commences in March and April.

We hope the present issue of the Journal will be appreciated but we have misgivings as to the future. We have very little reserve matter beyond a continuation of the interesting papers on Kashmir contributed by that veteran naturalist Col. Ward. Members have never let us down in the past and we appeal to them not to do so now.

We must congratulate our printers on the settlement of the industrial troubles they have been going through, and we hope that the year 1928 will witness the Journal issued with more regularity than it has been in 1927.

OBITUARY

CHARLES ECKFORD LUARD

With deep regret we record the death of Lt.-Col. C. E. Luard, C.I.E., at his residence, ' Woodsend ', Boars Hill, Oxford.

Lt.-Col. Luard, a son of the late Col. C. H. Luard, R.E., was educated at Marlborough and Christ Church, Oxford. He came out to India in 1892 and after six years of service with the 8th Gurkhas was transferred to the Political Department as an assistant to the Agent to the Governor-General in Central India. The major portion of his service was spent in the Central Indian States and his long official connection and close study of these States made him perhaps the foremost authority of our times on this important group of Indian States. Although more of a ' Savant ' than a ' Political ' Col. Luard was esteemed and respected by all those he came in contact with both in his official and private capacity. He gained the warm regard of the ruling princes and was quite as popular with his European colleagues. Col. Luard wrote the *History of the States in Central India* and also compiled a valuable bibliography of that history. The portion of the *Imperial Gazetteer* dealing with Central India was prepared by him ; while his recognized intimacy with the history, people and rulers of Central India led him to be deputed on three successive occasions, viz., 1901, 1911 and 1921 to prepare the decennial census reports. Col. Luard joined the Society in 1906 and was a frequent contributor to the pages of its journal. In the present issue of the Journal we publish the last of the contributions received from his pen—' The Ornithology of the Bible'. Other articles by him of a similar nature, ' Deer Hunting in Shakespeare's Day ' and ' Shakespeare on the Noble Art of Hawking ' reveal his leaning towards this rather fascinating line of research.

Col. Luard, who was made a C. I. E. in 1923, married in 1903 Alice Margaret, daughter of Mr. James Todd of Aberdeen and leaves two sons and a daughter.

MISCELLANEOUS NOTES

I.—READERS' VIEWS ON 'GAME PRESERVATION IN INDIA'

You have started a discussion in vol. xxxi of the Journal, Nos. 3 and 4, and have invited others to give their views on 'Game preservation'. There can be no doubt that the preservation of Indian Fauna is a question requiring immediate attention.

In your article in No. 3, you go straight to the root of the trouble when you point out that it is the fact that game trophies, whether hides or horns, are allowed to be sold by law, which is mainly responsible for the heavy decrease of game in most districts.

There are two points I should like to touch on. You sum up as follows:—

'The impression gained from the letters read is that what is principally needed is a law forbidding the sale of any part of a big game animal.' So far so good. I heartily agree with this; *but* you go on to say 'carnivora excepted'.

Point No. 1. Why should Carnivora be excepted? I may say without fear of much contradiction that carnivora, i.e., tiger, panther, bear, afford just about *the* most exciting sport of any. Why then should they be excepted from a law which it is proposed to introduce in order to preserve big game for sporting as well as for Natural History purposes?

Another potent argument in favour of not excepting them from sale is this: Big game sportsmen do not (at any rate the true sportsmen certainly would not) ever sell any of their trophies, least of all tiger, panther or bear. It therefore follows that carnivora skins sold must be those killed either by poachers or by people who are not sportsmen at all but who merely shoot carnivora as matter of business, when they have the luck to be placed in the middle of the tiger and panther jungles, and are thereby selfishly depriving real sportsmen, who have probably spent a lot of money in getting to their blocks, of a chance of enjoying well-earned sport.

I therefore strongly urge that if any law is agitated for to be passed, it should be made to include carnivora, or at any rate, tiger.

Point No. 2. You go on to say 'Save by a Forest Officer in the public interest.' This requiries, I think, some elucidation. Personally, I would not leave any sort of loophole if the law is to be really effective. So many good laws have been rendered ineffective by some such weak clause.

Let us examine this second exception. In what exact public interest would it be to sell skins of any game animal, or horns? If it refers to shed horns, I fear that it would be only too easy for forest guards and coolies or others to shoot animals for food and produce their horns as picked up shed ones. I have not come across or heard of any district where horns and hides lie about in such profusion that it would be worth while collecting, advertising and selling them, The amount realized I should say would not be commensurate with the labour and time of the forest guards wasted in searching the country for them.

I have recently been in one of the best districts in India for chital, hog and barking deer. Though of course they had shed their horns long ago, Chital were to be counted in herds of 200, swamp Deer I saw in herds of 50 and 60, hogdeer in herds of 20 (I counted 23 in one herd, which must be very unusual) and Barking Deer 5 and 4 together. Although I was moving all over the block for fifteen days all day and every day, I picked up 1 chital head and 1 horn of a hog deer.

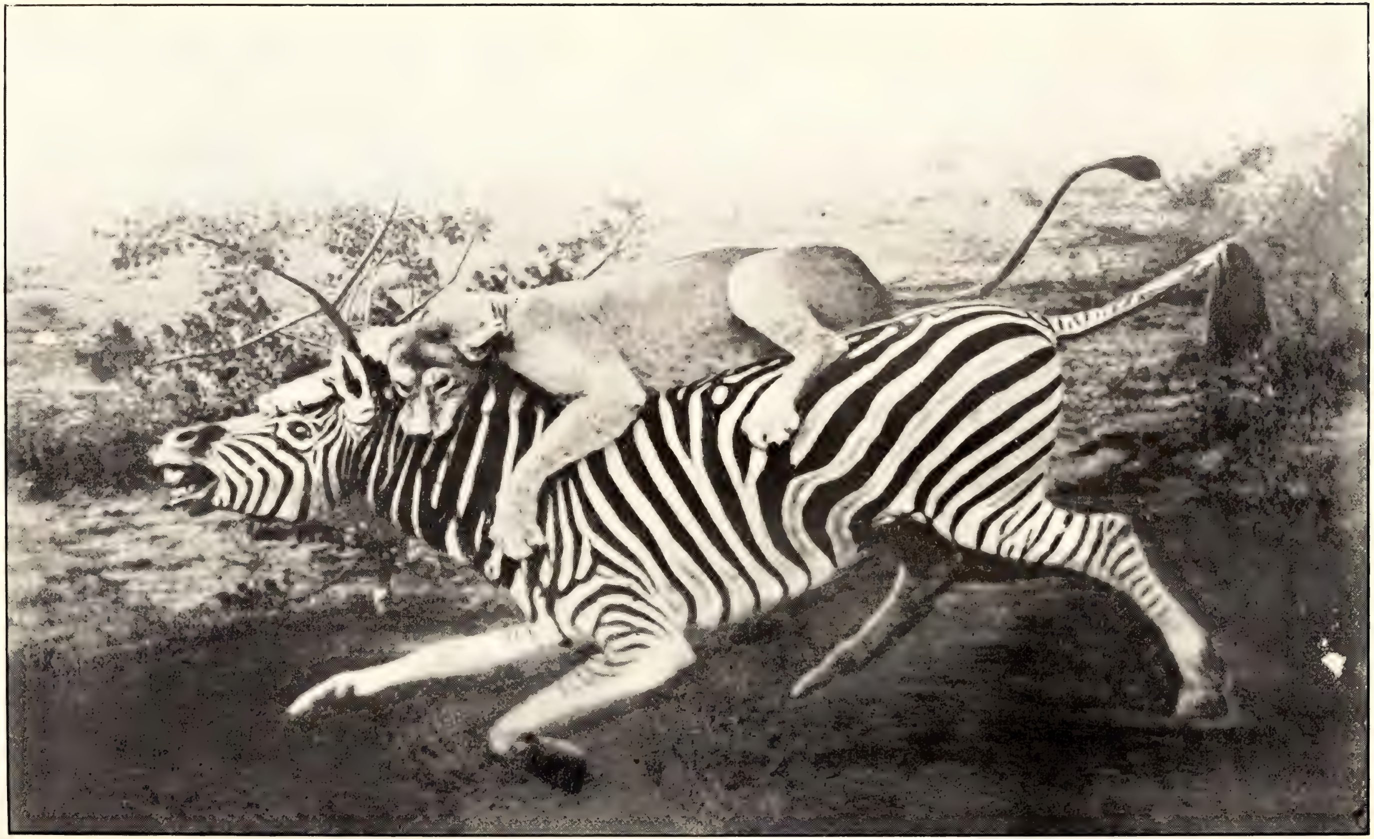
I should be very glad if you can let me know what steps are being taken to get Government to pass legislation on this important subject.

Turning now to Mr. Brayne's suggestion, in No. 4 of vol. xxxi, page 1020. I certainly think something of the sort should be started. The syndicate idea, Mr. Brayne says, has already been turned down by the Forest Department, so I need not refer to it, except that one should like to know their reasons ? As regards his second suggestion, I think that a Game Preservation Society would be a first-rate scheme ; a definite organization like this would be of immense value in many ways.

For one thing, here you would have a big body of big game sportsmen which would, by fear of public opinion, greatly curtail the present shooting of wretched immature sambur, chital bucks, etc., etc. if it did not actually get legislation passed on the subject. It has always been a matter of astonishment to me that there are such excellent rules and penalties in the Kashmir Game Preservation Department and yet there are none in British India. The most that forest shooting-block passes do is to limit the number of heads one may shoot Nothing is said as to size, an equally important point if not more so. I have met young sportsmen in blocks who had not the vaguest idea as to what size a shootable sambur or chital was. The Kashmir Game Laws are to my mind the model of what Game Laws should be.

The Game Preservation Society, again, would in time be able to place the best material as watchers in the forests, with heavy penalties (such as loss of pay and dismissal) in case of bribery by poachers, etc.

Again, the Society would be able to assist its members in the many ways which a sportsman requires and which are now denied to him, unless he be a highly placed official such as the Governor of a Province, or unless he be a Policeman, Commissioner or Forest Officer. This particularly applies to the U.P., as only the above-named people can obtain elephants or beaters and other assistance. The ordinary sportsman (military or business man) is tremendously handicapped if he has to deal with a wounded tiger or panther. In fact, it is 100 to 1 against his getting it. Recently I had to leave a wounded panther (a very big one too) in my block, as I could not secure the services of any men, elephants or buffaloes to follow it up. I followed it up alone for hours, a most hazardous game, as one had to force one's way through thick long grass (over one's head) as quietly as possible, an very exhausting and dangerous



YOUNG LION ATTACKING A ZEBRA.

business. I had to give up in the end, leaving the panther as a potential source of danger to any forest people or others in the neighbourhood. Had I had an elephant, I could have followed the panther all day if necessary and of course with vastly increased chances of seeing it, looking down as one could have done into the grass. I may say here that I tried my best to get even one elephant before entering my block, but neither the civil authorities, nor the Forest Department could (or would) assist.

AJMER, W. M. LOGAN HOME,
July 11, 1927. *Major*,
4th Bombay Grenadiers.

[Although the extinction of the big carnivora would mean an increase in those animals which, when in large numbers, are a curse to the agriculturist, we do not think the prohibition of tiger shooting altogether by non-license holders or by any except sportsmen would be practical politics. It might be necessary—we can imagine several instances when it would be in the public interest—for the Forest Officer to shoot tigers and it would certainly be in the public interest for him to seize tiger shot contrary to law. Possessing the trophies, would it not be in the public interest for him to sell them for the benefit of the public ? EDS.]

II.—A UNIQUE LION PHOTOGRAPH

(With a plate)

The accompanying plate of a young lion attacking a zebra is perhaps the most unique photograph ever obtained of a lion in his native environment. The photograph came into my possession through the late Mr. C. A. Latif, a prominent citizen of Bombay, who had resided in Zanzibar for a considerable number of years towards the end of the last century.

From the particulars furnished by this gentleman it would appear that the photo was taken by an engine driver on the then newly opened Uganda Railway, which as is well known, even now runs through some of the finest game country in the world. The engine driver got his camera ready to photograph a herd of zebras as they stood a short distance from the line, gazing in wonderment at the weird and unfamiliar object that had invaded their territory and rattled so glibly along the iron rails. The instant he pressed the shutter a young lion sprang from the surrounding scrub on one of the zebras, and this was the resultant exposure ! If I have understood correctly, Mr. Latif was a passenger on this very train, but even if he were not, the driver was known to him personally and it was he that presented Mr. Latif with a copy of this remarkable photograph.

The coincidence and the circumstances sound positively miraculous and I should hardly have credited the account had it come from a less reliable source.

The photo was in Mr. Latif's wonderful private collection of curios collected all over the world and to my mind there appears no reason to doubt its authenticity and genuineness

Strangely enough I find the identical photograph considerably touched up and reproduced in Hutchinson's 'Animals of all Countries' (part iv, p. 173). All that is there mentioned about it is 'By permission of E. N. A.'

It would be very interesting to learn who 'E. N. A.' is, how the photograph came into his possession and if he has another version as to how it was secured by the camera-man.

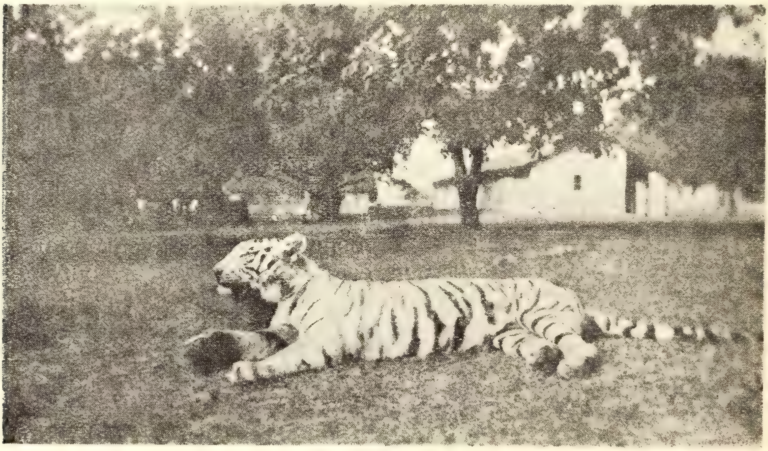
BOMBAY NATURAL HISTORY SOCIETY, SALIM A. ALI.
6 APOLLO STREET,
September 5, 1927.

III.—WHITE TIGERS

(*With a photograph*)

I have recently had the luck to shoot a white tigress and would like to know if any other members of the Society have ever done so. I may mention that, not long after, a lady, Mrs. Murphy, wife of Mr. P. W. Murphy of the I.C.S. of this Province, also had the good fortune, when out with me to bag another one, also a tigress, and very much the same colour as the one I got. The animal I shot was pure white with black stripes on her body and russet brown ones on the tail. Both were well grown beasts, thick set, and taping respectively, 8′–5½″ and 8′–2″ between uprights. They were shot in the same jungles, but about twenty miles apart, in the district of Bhagalpur.

I enclose a photo of the animal I shot for publication in your journal if you like. The taxidermists to whom the trophy was sent report that during the year 1926 they received three white tiger skins including mine (mine was shot on December 6, 1926), but my skin is the only pure white one, the other two being cream coloured.



The animal was not an albino, as it did not have pink eyes, but the ordinary coloured eyes of a tiger, and so did Mrs. Murphy's. Is it possible that there is a distinct breed of white tigers, or are they only freaks ? I have for years past been told by my shikaries that there was a white tiger in the jungles near here, quite twelve years ago. Herders who saw the animal, described it as *ek dum gaike mātik safēd* (white like a cow). I never believed them till I shot the tigress which must be a descendant of the white one seen by the herders years ago. Both the tigresses were young animals, about three or four years old. I once did see a white animal pass a little distance from a kill which I was sitting up over, and at the time thought it must have been a hyæna. It was bad moonlight and in thickish jungle, but I was rather suspicious at its making no noise in the leaves, which a hyæna usually does with its clumsy tread. I now think it must have been a white tiger. Both the above tigresses were shot in a beat, and took a good deal of lead. I hit my tigress from about twenty yards away through the right shoulder, bowling her over ; she however managed to scramble away, and I missed with the second barrel. I followed her up soon after for about 100 yards, but did not find much blood, and had to give up for that day as it was getting late. The next day I found her fully 1000 yards away from where I originally hit her and polished her off with a shot through the neck. On skinning her I found that my first shot had gone through the shoulder and the bullet or rather parts of it were found under the skin on the opposite side, her liver being in shreds. Surely it is exceptional for a wounded tiger with such a fatal shot to go so far. The bullet used was a Contractile from a smooth bore (12-bore).

I shall be much interested to hear what information you can give me in regard to white tiger.

F. B. ROBINSON.

SAGRAMPUR,
BIHAR AND ORISSA,
January 28, 1927.

[Mr. Robinson's tigress is yet another of the many examples of complete or partial albinism recorded among tigers in recent years. Partial albinism is defined as a condition in which certain areas of the body remain marked by more or less well defined areas of colour owing to the presence of more or less pigment. It is believed that a pigmented animal owes its colour to the power that certain tissues of its body possess to secrete tyrosinases (oxydizing ferments) and chromogenic substances—the colouration being the result of the action of the ferments upon one or more of the chromogens and the theory is therefore put forward that an albino is an individual whose skin lacks the power to secrete either the ferment or the chromogens—it may hold one of these substances, never both.

But the presence of both these colour determinants are not alone sufficient to explain the development of colour which is arranged in animals in a definite pattern, either self, spotted, striped, etc., and it is believed that colour is correlated with some other factor which determines the pattern—each special pattern having its own determinant and it has been shown that, while an albino may not possess the factors which determine colour, it may still possess factors which determine pattern, both visibly in the body tissues or as a gametic character; when its presence will only be detected in subsequent generations.

The frequent records of white tigers in recent years has been remarkable. On looking through our Journals we find no less than seventeen distinct records of white tigers shot in India during the last twenty years—a period during which certainly less tigers were shot than formerly if we are to credit the records of the old Sporting Magazines. The question arises as to whether these frequent records can be looked upon as instances of variation tending to the formation of a new variety or race. If there is anything in the theory of protective colouration in reference to the tiger, then the white colouring would be an obvious disadvantage militating against the establishment of such a race, and yet these tigers appear to thrive quite as well as the normal coloured animals from the fact that their records are becoming more and more frequent.

Do white tigers breed white tigers is a question on which naturalists and sportsmen are, as in the case of black panthers, inclined to differ. The white tigers of the Rewah State would appear to belong to the same family and to have bred white for several generations. Mr. Robinson assumes his tigress to be the offspring of white parents. The black panthers in the Kolhapur Zoo have bred black panthers for several generations. Eds.]

IV.—A TUSSLE BETWEEN TIGER AND BUFFALO BAIT

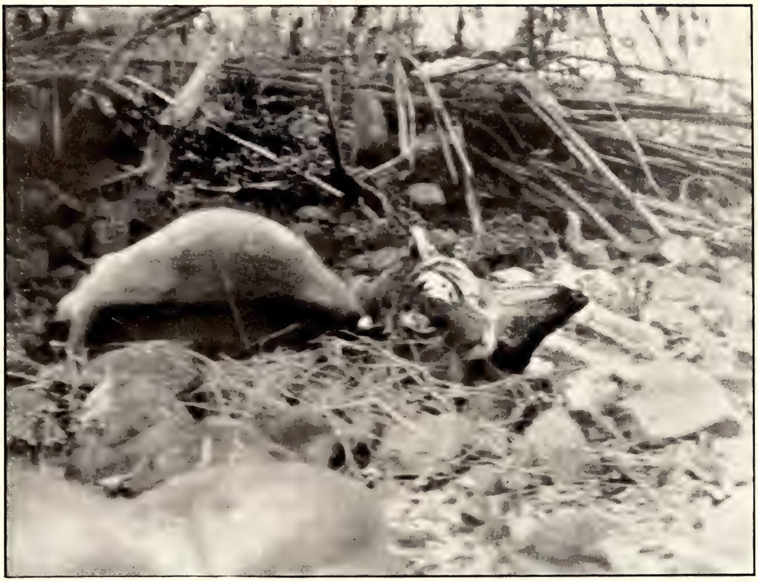
Whilst shooting in the Central Provinces in February this year, a buffalo calf, tied up for a tiger bait, showed signs of a struggle with a tiger when visited in the morning. Unfortunately, having injured my leg, I was unable to go and see that calf but several independent witnesses and a reliable shikari were all questioned and no discrepancies occurred in their answers.

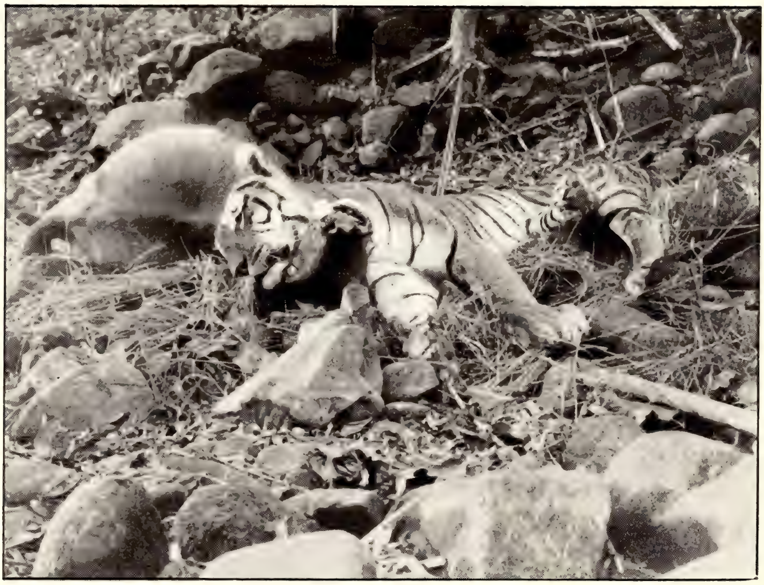
The calf bore marks of claws and teeth all over its back and, though it had subsequently to be destroyed, was still alive. Its horns were covered with blood and tiger's hair and it must have given nearly as good as it took.

A tussle between a 2½ year old tethered calf, and a tiger strikes me as rare; the tiger may have been frightened off by passers by, but even so the tussle lasted sufficiently long for the tiger to inflict a large number of wounds and the incident is an example of the stubborn courage of the domestic buffalo.

United Service Club,
Pall Mall, S.W.,
June 7, 1927.

J. Mc. C. CLIVE,
Captain, M.C.





A TIGRESS AND ITS KILL.

V.—UNUSUAL BEHAVIOUR OF A TIGRESS WITH LIVE BAIT

(*With a plate*)

I have recently been shooting in the C. P. with Capt. Graham of this Regiment. We found we had to deal with a tigress which would not return to her kills, so we took it in turns to sit up over a live bait. On the third night the tigress attacked the bait at about 12·30 a.m. Capt. Graham saw the tigress standing firmly with all four feet on the ground and holding the side of the buffalo calf's throat in her jaws. In this position she pinned the animal's head to the ground.

It was in this position that Capt. Graham shot the tigress, which fell dead on the spot.

In the morning I went out and photographed it, and I now enclose the prints, which may possibly interest you or some of the readers of your Journal.

THE RIFLE BRIGADE,
LANDIKOTAL, INDIA,
June 3, 1927.

F. O. CAVE,
Captain.

VI.—WHAT IS THE RECORD PANTHER?

I read a remarkable statement which I expect a good many other members of the Society will also have read, in the issue of the *Sporting and Dramatic* for July 6, 1927, as follows :—'Rowland Ward's Records gives the length of a leopard killed in S. Nigeria before skinning as 9 ft. 3 in. while the record Indian specimen is one from Kashmir measuring 9 ft. 1 in. The average of a good Indian panther, before being skinned ranges from 7 ft. 9 in. to 8 ft. 6 in.' Now this statement is absolutely contradictory to all previous records, observations and articles appearing in any of the Society's Journals and also in any standard work on Big Game Shooting. I refer readers particularly to Col. A. E. Ward's able and authoritative articles in vol. xxix, No. 1, page 25 and vol. xxxi, No. 1, page 3.

As I have quoted the *Sporting and Dramatic* article, I propose to do the same with Col. Ward's observations.

'There is no doubt that an animal 8 ft. length measured between 'pegs, or even by taping from the nose between the ear and then 'straight to the tip of tail, is very rare.'

Col. A. E. Ward then gives a table of record leopards the biggest of which is 7 ft. 5½ in.

Again 'A full grown male leopard may be from 6 ft. 9 in. to '8 ft.; an eight-foot leopard measured between pegs is very un-'common. In Rowland Ward's Records of Big Game a measure-'ment of 8 ft. 3 in. is given and 8 ft. is recorded of two specimens 'at least; and then we have 7 ft. 6 in., 7 ft. 5½ inches.'

With all the above I most emphatically agree and all sportsmen to whom I have spoken on the subject have the same opinion. It is therefore most difficult to understand the statement made in the *Sporting and Dramatic* and I suggest the Society might collect further opinions on it and at the same time ask the Editor of the *Sporting and Dramatic* to give further particulars, such as

(1) Who gave the information regarding these gigantic brutes of leopards (bigger than any tigress ever known and equalling most average tigers !) ?
(2) Who actually measured them and how ?
(3) What other witnesses were present ?
(4) The date and place where shot or otherwise killed ?
(5) Where are the skins now and what do they now measure?
(6) Will the owners very kindly allow two or three well-known big game hunters to view the skins ?

In this connection I might observe that the dressed skins would normally measure, for the 9 ft. 3 in. one = 10 ft. 10 in. and the 9 ft. 1 in. = 10 ft. 8 inch. As regards the Kashmir one it is difficult to understand how Col. Ward did not see or even hear of it. Is it in the Kashmir Game Records ? This point could be verified easily. If not, why was the owner so very retiring and modest after shooting almost the world's record panther ? !!!

As regards the statement that the ' average of a good Indian panther before being skinned, ranges from 7 ft. 9 in. to 8 ft. 6 in.', this is frankly incredible and gives a totally erroneous idea which I am sure the majority of big game sportsmen will not agree with.

AJMER,
August 2, 1927.

W. M. LOGAN HOME,
Major.

VII.—A PANTHER AND FLASHLIGHT

(*With a plate*)

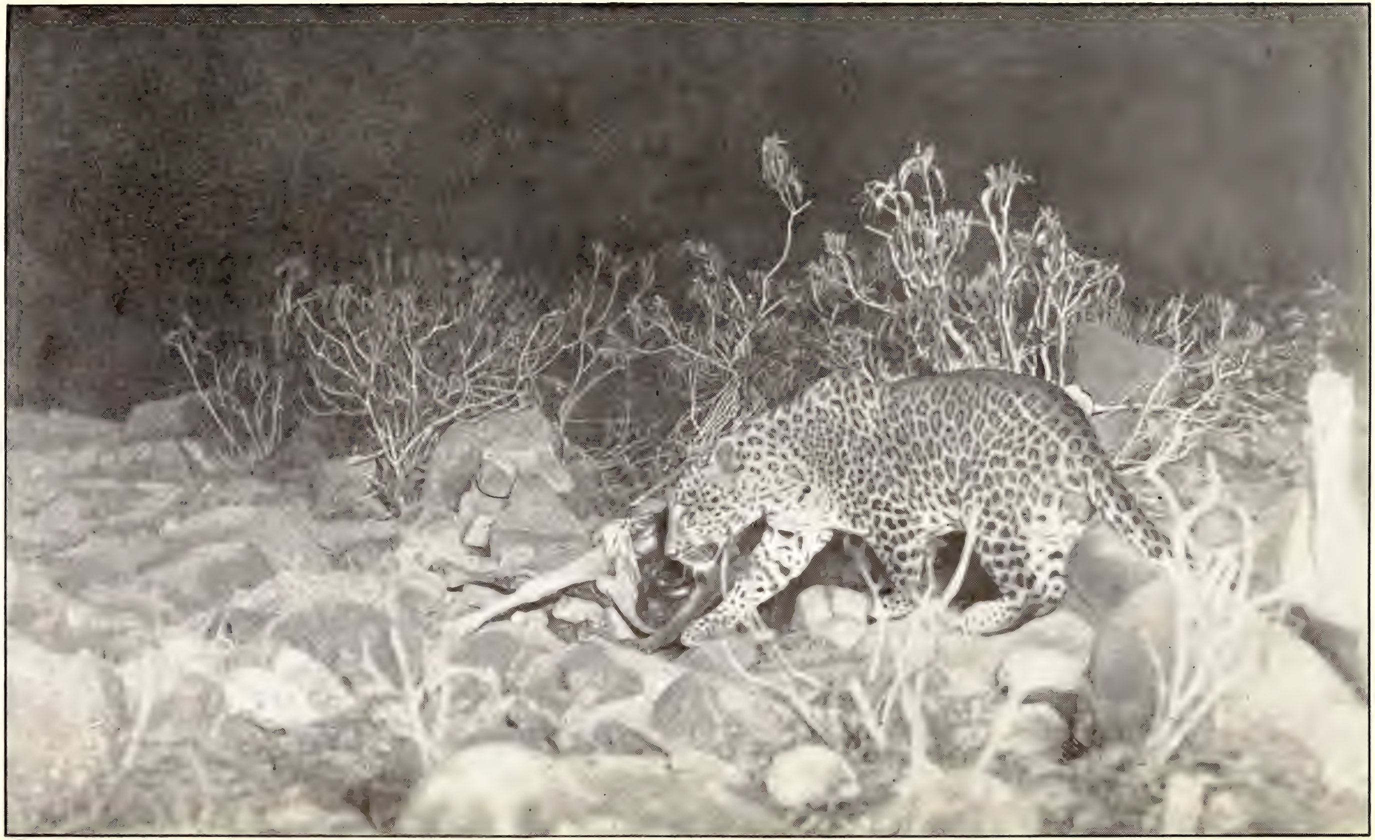
This photograph of a panther was obtained in the foothills of Garhwal. The panther was fired at from a *machan* when it was just too dark to aim properly and within half an hour came back to its ' kill ' in the open river-bed, 100 yards from the *machan*. It set off the flashlight, which makes a noise like a grenade, and yet returned and ate most of the ' kill ' during the night.

Panthers in this part of Garhwal always return when they are fired at and missed. If, however, on their first approach they see anyone in a *machan* they will remain close by for an hour or so and then go away and do not return even when the *shikari* has gone home.

B. A. S. BRUNSKILL,
Major.

VIII.—BOLDNESS OF PANTHERS

I was out one morning alone after a Chital and was returning at 7.30 a.m. along the edge of the jungle. To my right was a vast expanse of open grassy plain known locally as a *Chauri*. I saw some animal a long way off moving from left to right out into the plain, when I got the glasses on to it, I saw to my surprise it was a fine panther, its coat glistening in the bright sun. I at once sat down and watched. It continued to walk along quite unconcernedly getting further and further out into the open plain. I guessed that it was making for a kill and this proved to be the



A PANTHER AND A COW "KILL."

(The Cow's nose appears just above the Panther's hind-quarters.)

case. It disappeared into some rather higher grass and then started returning with an animal in its jaws. I then commenced running, crouching through the grass, which was only knee-deep and managed to get within 300 yds. without the panther taking any notice though I was in full view more or less the whole time. I then saw that he would soon reach the edge of this jungle and so I took my chance and fired, and missed (the bullet went high and behind him). He dropped the kill and bounded off into the jungle. I got up and walked about 50 yds. when I saw him coming stealing back. I at once got into a sitting position again and fired when he had stopped to pick up his kill; but again missed. This time I ran crouching as hard as I could and made about 80 yds. and then sat down and hardly got into position when he again came stalking back out into the open, picked up the kill and walked unconcernedly off. I fired and this time hit him. He staggered off and when I reached the spot, I found it was a full grown Kakur he had been carrying. I went back to the bungalow and got three men and tracked the animal. I think this is a remarkable case of boldness and fearlessness on the part of this panther.

On another occasion, a few days later, I sat over a fresh kill (a cow) which had been dragged over 400 yards. I was in position at 6 p.m. and my man left me at that time. At 6.10 a magnificent panther arrived, quietly walked up to the kill, never looking to right or left, and at once seized it in his powerful jaws and began dragging it off backwards. I got him through the back of the neck and he died then and there, biting his left fore arm in his jaws. My man had only gone about $\frac{1}{4}$ mile and in fact was still walking away when he heard the shot. The panther must have been sitting waiting within earshot and close indeed.

While on the subject of panthers, I should like to protest against a statement I read in a big game book recently that ' the panther looks what he is, a perfect swine, while a tiger always looks a gentleman ! ' I think that is a remarkable statement, and personally I (and a great number of sportsmen agree with me) have exactly the opposite opinion. In view of my recent experience in the Terai, I consider a panther is a most sporting animal and gives one a very good chance, whereas a tiger is a skulking nocturnal beast, who has to be driven out to the guns ; he very rarely ever comes to a kill in daylight, and curiously enough the book I mentioned brings out this very point.

A tiger more often than not will not return to its kill even when not tampered with, whereas the sporting panther comes back to his kill even when one has dragged it 100 yards and often to only a head and a few bones. Such is my experience and it is the experience of a great many more experienced shikaris than myself. Take again the case of man-eaters ; far more tigers become man-eaters than ever panthers do. I wonder if the author of that statement considers *man-eating* tigers as gentlemen ! !

AJMERE,
July 8, 1927.

W. M. LOGAN HOME,
Major,
4th Bombay Grenadiers,

IX.—CIRCUMSTANTIAL ACCOUNT OF A PANTHER ATTACKED BY WILD DOGS

The following may be of interest to members :—

Whilst shooting in the Central Provinces a few years ago a friend of mine found a panther in a dying condition. When dead, the panther was brought into camp and examined and skinned. The animal had been emasculated, the wound thus formed including the anus, no other wounds being found.

On removing the skin it was found that practically the whole of the entrails had been drawn out through the wound.

The only possible explanation was that this was the work of *Cuon* ; both my friend and his brother, who was present, are experienced shikaris and their veracity cannot be questioned.

The panther may, of course, have been in a feeble condition when attacked but even so the occurrence is remarkable.

I cannot think of any other possible explanation. My informant emphasized the fact that the panther was alive when found.

United Service Club,
Pall Mall, S.W.1,
June 16, 1927.

J. Mc. C. CLIVE, M.C.,
Captain.

[In vol. v, p. 191 of the Journal, there is an account of a pair of panthers being treed by wild dogs. The two panthers were in a 'Sallai' tree, one above the other with a large pack of ten or twelve couple of wild dogs moving about below. A similar instance is recorded in vol. xviii, p. 194 of the Journal, in which a pack of wild dogs was seen in pursuit of a female panther. R. C. Morris in a note on wild dogs, vol. xxx, page 691, says he saw the remains of a panther that had been killed by wild dogs. It seems well established that panthers are occasionally attacked and killed by wild dogs—bears have also been attacked—while the belief is current that even tigers are not free from attack from these vermin—but the cases so far recorded in reference to tigers are based mainly on hearsay evidence. As regards the dogs having emasculated the panther, see Note No. XI on the opposite page. Eds.]

X.—WILD DOGS

There has been some correspondence about wild dogs lately. It has been alleged that there are two species (which I do not believe) and mention has been made of the colour of the tip of the tail. I have just received from the American Museum of Natural History, New York, three specimens, about two-thirds grown which were shot *from the same small pack* by Kunwar Dillipat Shah of Khairigarh. One of these has a black tip to the tail, another has a few white hairs, and the third has a distinct white tip to the tail like that of the silver fox. These three dogs were presumably of the same litter of puppies.

Oriental Club,
London,
September 3, 1927.

J. C. FAUNTHORPE,
Colonel.

[Only two species of wild dog have hitherto been recognized: *Cuon dukhunensis*, the wild dog of the whole of India and *Cuon rutilans*, the wild dog of Burma and the Malay countries. There is however a belief prevalent in India from Kashmir to Cape Comorin that there are more than two species and that in addition to the '*Jangli Kuta*' of the plains there are two hill kinds, one larger and the other smaller—the small breed is said to limit its range to the low ravines and to restrict its attacks to sheep and goat while the larger breed hunts in the higher mountains. It has been suggested that the smaller breed is really a pack of females and cubs, the mother training the young idea in the arts of hunting and naturally blooding them on easily killed quarry, while the full-grown packs roam the forest attacking what they may. EDS.]

No. XI.—HOW WILD DOGS KILL THEIR PREY

A recent issue of the Journal, vol. xxxi, page 813, contained an account of a sambhar stag in Burmah having been emasculated by wild dogs and the affirmation of the local shikaries was that this was their invariable practice. As the article implied a contradiction of my remarks on the subject in 'Wild Animals in Central India' which was referred to, perhaps you will be good enough to publish what I believe to be the explanation of this widespread belief.

Anyone familiar with the East knows of the exaggerated importance attached to anything connected with the organs of reproduction. The very idea of emasculation is horrific! Occasional and isolated instances of this having taken place are discussed with bated breath, possibly dwelt upon with a lascivious satisfaction. That emasculation 'may' take place immediately becomes that it 'does' take place. The mind of the jungli native construes this as a dreadful and purposeful action on the part of the wild dog.

Now for the fact that emasculation occasionally takes place and the explanation thereof. When an animal is attacked at bay the dogs launch themselves on the head and seize it clustered like ticks on every conceivable place. If the pack happens to be a large one there is no room on the head for those diffident in attack and so these immediately attack the hind quarters. This is the normal procedure generally of a pack of dogs. It constantly happens when a bobbery pack attacks a jackal or a pie dog. The victim is seized at both ends and stretched.

It would be surprising if under such circumstances some dog did not find the scrotum and testicles of any stag a most convenient mouthhold and that before the struggle ceased these did not occasionally become detached. That emasculation is either a common or a deliberate act I can deny from a wide personal experience of the wild dog and its habits.

I have now explained how this operation is sometimes performed fortuitously and I have suggested how an 'occasional occurrence' has been converted into an 'invariable practice' in the natives' mind.

Anyone reading *Wild Animals in Central India* will see that I state as follows :—

"The story to the effect that they (wild dogs) are in the habit of emasculating the animals they attack can be discarded". This sentence was purposely worded so as to make it clear that although emasculation might sometimes take place it was not habitual. The habit is denied, the act is not.

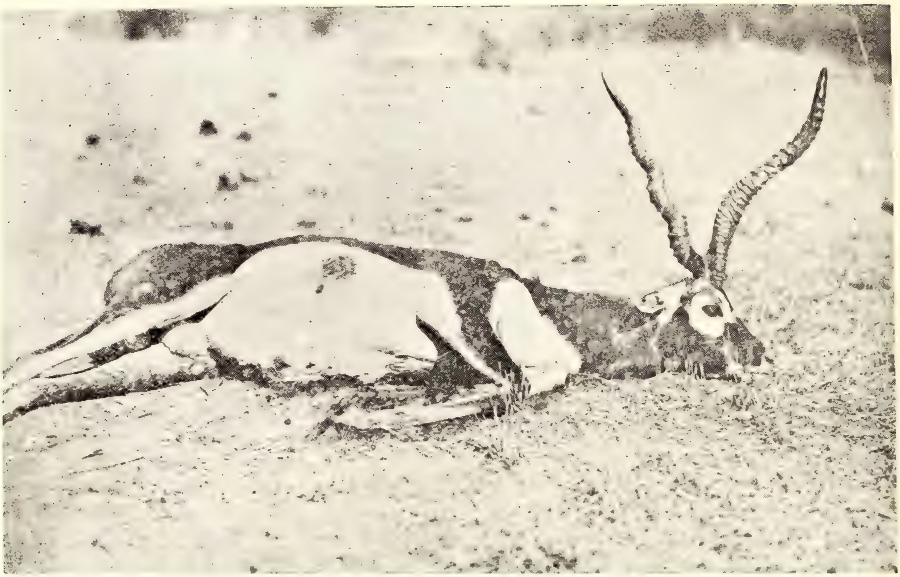
Ivy Bank, Elgin, A. A. DUNBAR BRANDER.
Scotland,
August 14, 1927.

[The belief that the wild dog emasculates its quarry is very prevalent in India, as also is the belief that they sprinkle bushes with urine and drive their prey through them and then rush upon their quarry which is blinded by the acid fluid ! Emasculation does occur but is, as pointed out by Mr. Dunbar Brander, the result of chance and not of deliberate effort. Eds.]

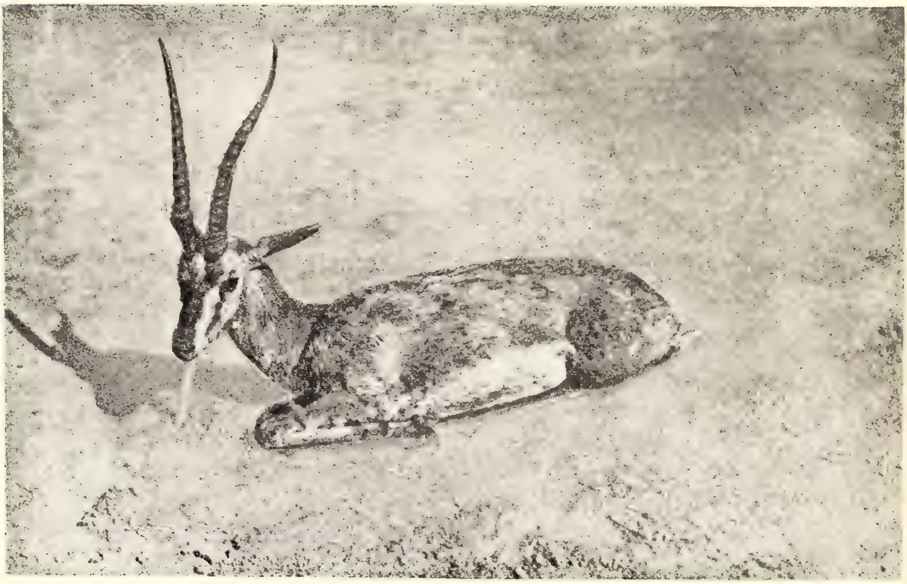
No. XII.—THE RECORD FOUR-HORNED ANTELOPE (*TETRACEROS QUADRICORNIS.*)

(With a photo)

In February of this year we received a very fine head of this animal for mounting, shot by Col. E. Conway-Gordon in the Central Provinces. On examination the rear horns proved to be far above the known record and the fore-horns also exceeded those of the best head.



Abnormal Blackbuck shot in Bikaner.



A Good Chinkara Head from Bikaner. Horns, 14¼″.

The measurements were taken when the head arrived and then again at the time of writing, when the head was completed and thoroughly dry. It will be seen from the table given below that there has been a considerable amount of shrinkage.

—	Length of rear horns.		Length of fore horns.		Circumference.	
	R.	L.	R.	L.	Rear.	Fore.
On arrival	3¾″	7¼″	2¾″	3″	...	...
On September 9, 1927 ...	3¾″	6¾″	2¾″	2⅞	2⅜″	2⅜″

The right rear horn is broken as will be seen from the accompanying photograph. The core of this horn travels right up its length and measures 3½ inches. The core of the left rear horn on the other hand is very short being only 1¾ inches.

The rear horns spread outwards and owing to their being broken the tip to tip measurements cannot be taken. The front horns converge inwards and the tip to tip measurement between them is one inch.

The best head in Rowland Ward's 'Records of Big Game' (1914) measures: rear horn 4½″ : fore horn 2¾″.

Bombay, C. McCANN.
September 9, 1927.

XIII.—ABNORMAL BLACKBUCK AND A GOOD CHINKARA HEAD FROM BIKANIR

(*With a plate*)

I am enclosing two photographs which I trust will be of interest to you. The blackbuck carries an abnormal head, as is clearly seen from the photograph, and was shot by His Highness the Maharajah of Bikaner in the north of the Bikaner State at Hanumangarh. The chinkara, which measured 14¼″, was shot in the north of the State near Ganganagar by the Maharaj Kumar Sahib. It is practically a record for Bikaner; only one bigger head measuring 14½″ is known to have been shot in the State so far.

Bikanir, SURAJMAL SINGH,
Rajputana, *Secretary to*
August 31, 1927. *Sri Maharaj Kumar Sahib.*

XIV.—CLICKING NOISE MADE BY MUNTJAC

I remember having read in some of your Journals different articles attributing the curious clicking sound made by the Barking Deer to various causes. While at the local Zoo sometime ago I was watching the Muntajc in the enclosure, when I suddenly heard the buck making this peculiar noise. The little animal was on the other side of the railing to me and not more than about a yard away. It was moving to and fro parallel with the railing and clicking away merrily. I sat down and watched it most carefully for a long time and found that the noise was distinctly produced by the animal's mouth. The clicking noise was made with the tongue and the lips at the same time, much like a clucking hen. The mouth was not open but every time the tongue clicked the ends of the lips were drawn back. I asked the keeper, and he informed me that this often occurred and was a sign of pleasure. Recently Mr. C. Raitt of Faith Estate, Kutta P.O., S. Coorg, was with me at the Zoo and he also heard the same noise and said it was made by the mouth.

I have seen it stated by some that the noise was made by moving the tushes in their sockets. This is a physical impossibility, because the tushes, although set loosely in their socket are yet imbedded in a cushion of muscles and flesh; which excludes all possibility of any clicking sound being produced, though the tushes could be moved about to a certain extent by external means and not by its own power. Whether the doe also makes this clicking sound I am unable to state, but I do not see why she should not be able to.

I have also read that the clicking noise was made by the hoofs but I do not think this is correct.

MYSORE, CHARLES THEOBALD,
S. INDIA, *F.Z.S.*
September 2, 1927.

XV.—THE BRAY OF THE CHITAL STAG

My attention has been drawn to Miscellaneous Note No. III, page 694 of vol. xxx, No. 3 (which I have somehow missed seeing before). I refer to the note on the Chital.

Mr. Morris says, 'I would not describe the call (*sic*) as in the nature of a whistle at all.' I presume he refers to the rutting season 'roaring' of the stags; personally, I quite agree with him. The chital stag's *roar* in the rutting season is, at any rate, from the Siwaliks to the Terai, very much the same as any other stag's roar, and certainly the Terai and Siwalik stags' roar could not be called a whistle, whereas their alarm note *is* distinctly a kind of whistling cry, which the does also utter. To my mind the chital stag's roar resembles the Kashmir Stag's and Scottish Stag's roar only it is not so loud.

AJMER, W. M. LOGAN HOME,
August 25, 1927. *Major,*
4th Bombay Grenadiers.

XVI.—MUSTH IN ELEPHANT

Col. G. H. Evans in his well-known book *Elephants and their Diseases* opens his paragraph on musth with the words 'Male elephants and very rarely females, on attaining maturity, are subject to peculiar periodical paroxysms of excitement . . . to which the name of musth is applied. . . .'

In view of the above statement by such a well-known authority, it may be of interest to your readers to know that during the Departmental Kheddah Operations conducted by the Forest Department in the Goalpara-Bhutan Mahal, Assam, 1925–26–27, two female elephants exhibiting unmistakeable signs of musth have been caught. The cases are as follows:

No. 1. A very large female elephant of the Kumeraband type was caught in November 1925. This elephant had very large tushes, and at first, from her size and build, might have been taken for a makhana. Although full grown she had never had a calf, and there is no doubt that she was barren. While in the stockade she gave a good deal of trouble and attacked her fellows and the koonkies, and eventually broke both of her tushes on a tree inside the stockade.

This paroxysm of fury while in the stockade was succeeded at the depot by an impassivity and 'don't care' attitude which was quite as remarkable. The temporal glands were greatly swollen and gave forth a profuse oily discharge. Her training proceeded with remarkable rapidity and she was able to go out without koonkies ten days after her capture. Shortly afterwards, however, symptoms of blood poisoning were observed, due to the severe wounds the broken-off ends of the tushes had caused in the mouth and the animal was released in an effort to save her life.

No. 2. A very large female elephant of the Kumeraband type caught in November 1926. This elephant was not of such fine build as the former and in addition had had a calf. Her temporal glands were swollen and gave forth a copious discharge. She seemed very drowsy while at the depot but her training proceeded without incident and she left for her owner's home about a month after capture.

The question as to what causes the condition of *musth* in elephants can be ascribed, is one that has not been satisfactorily answered. It is true that some bulls when in this condition court the society of females, but it is by no means an invariable rule and it cannot be dogmatically asserted that this condition is due to a lack of sexual gratification.

As regards both of the cases cited above they did not show any perceptible desire for male company at the time nor did tuskers or maknas at the depot exhibit any interest in them.

One cannot lay down conclusions from two cases only, but it seems clear that the symptoms of the condition in the male and female is exactly the same. First the violent stage in which all animals are attacked and pain does not seem to be felt. This is succeeded by a drowsy stage in which the animal takes its fodder as usual but seems oblivious of its surroundings, and the attack then appears to gradually wear off. In both stages the temporal glands are swollen and give out a characteristic discharge.

The first case apparently was captured in the earliest stages and the second in the latter stages.

Both these animals were caught in the month of November and in stockades which are a few miles off from one another. All the other numbers of the respective herds were normal.

Some years ago an Assamese gentleman, Rai Sahib Rajant Kanta Chowdhury of Sorbhog owned a female elephant which was locally known by a term which was the equivalent of 'female tusker.' This was a North Cachar elephant and owed its sobriquet to the fact that it had longish tusks and went musth regularly each year until its death recently.

Elephant attendants have told me that male elephants go musth up to an advanced age, in fact none of them could recall an elephant that had not gone musth even in its old age.

We shall not probably get an explanation of why female elephants sometimes exhibit these secondary sexual characteristics of the male until some anatomical light is shed upon the question.

The above lines are written in the hope that they may catch the eye of those interested in the problem and that some information leading to its elucidation may enlarge.

KOCHUGAON,
ASSAM,
January 5, 1927.

N. L. BOR,
Imperial Forest Service.

XVII.—A LARGE TUSKER ELEPHANT

The following are the measurements of the tusker elephant I wrote you about:—

Height at shoulder 10ft. 4½″.

	Length	Girth	Weight
Right tusk	... 6′ 2″	21″	85 lbs.
Left	... 6′ 3″	21″	86 lbs.
		Total ...	171 lbs.

The above were taken in the presence of witnesses and certified measurements were sent to Rowland Ward. What struck me about the tusks was their girth and symetry—a perfect pair! As regards height, this is of course difficult to get accurately, but it was taken between uprights, and the least I could make it was 10′ 4½″; taken at the highest point of shoulder, I made it 10′ 9″, but did not think this possible after all Sanderson says about their being no such thing as a 10′ elephant. He was 65″ round the forefoot. I think there can be no doubt of his being a record for South India. Apparently the Senior Ranee of Travancore thinks so too, for all my offers to purchase the tusks have been refused!

CHITTAVURRAI,
ELLAPATTI P.O., *via* PERIAKULAM,
SOUTH INDIA,
July 27 1927.

A. W. JOHN.

[There is a note in our Journal, vol. xi, p. 335, by Lieut. S. S. Flower giving measurements of tusks of Indian Elephants in the possession of the King of Siam. The largest of these measured 9′ and 9′ 10½″ respectively; they belonged to an elephant which is said to have been ninety years old when it died at Bangkok and are easily the record pair for the Asiatic elephant. EDS.]

XVIII.—A GOOD NILGIRI TAHR (*HEMITRAGUS HYLOCRIUS*)

The following measurements of a Nilgiri Tahr, or Ibex, may interest you as they constitute a record for this district (High Range, Travancore). He was shot in May 1899 by myself :—

Length 16⅛″ (16⅜″ when shot)
Girth at base 8⅜″

CHITTAVURRAI,
ELLAPATTI P.O., *Via* PERIAKULAM,
SOUTH INDIA,
July 27, 1927.

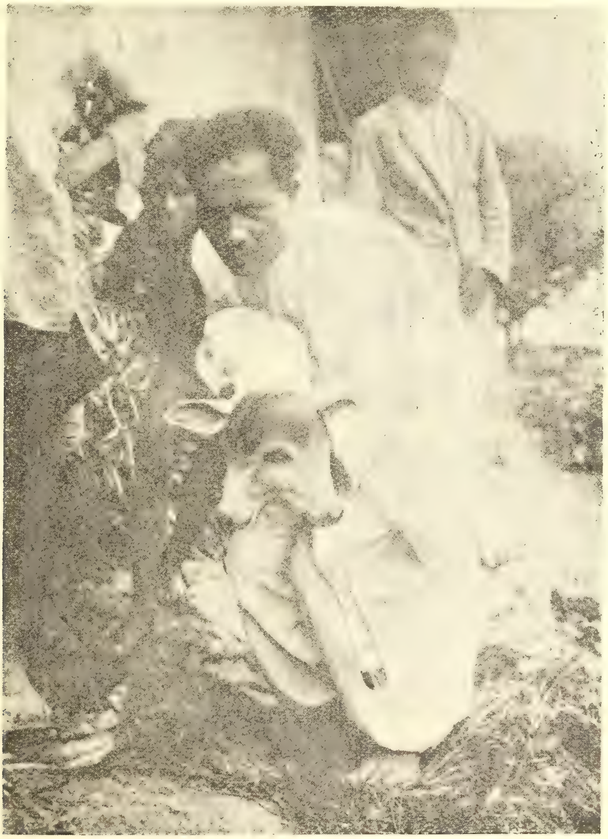
A. W. JOHN.

[A fine head of a Nilgiri Tahr was recently presented to the Society by Capt. H. R. Irwin. It was shot in the Nelliampathy Hills, South India, and measured 16½″, girth 9½″ (*vide* Journal, vol. xxxi, page 520. EDS.]

XIX.—BIRTH OF FREAK CALF AT INDORE

(*With a photo*)

With reference to a paragraph which appeared in the Current Topics column of the *Times of India* last month, the following



30 HOURS AFTER BIRTH.

notes and enclosed photographs may be of interest to readers of 'Miscellaneous Notes' in the Society's Journal.

Early in the morning of August 19 last, at the house of Baddrudin in the Palassia Mohalla, Indore, a calf was born with a bifurcated head, having two separate muzzles each with mouth and nostrils complete. The head had four eyes, two of which, one on each side, appeared to be normal, while the other two, joined together in the middle of the forehead, were sightless and 'dead' looking.

The calf had to be hand fed as its head was too heavy for it to lift. It sucked with both mouths.

Its birth, on Krishna's Day (*Janma Ashtami*), caused great excitement at Indore, and thousands of people from the city and the surrounding country came to see it and make offerings—much to the joy of the lucky owner.

Of the three photos enclosed, one was taken when the animal was about thirty hours old, and the other two (one of which is a side view in which the head appears to be quite normal), when it was eight days old. The calf died on the twelfth day.

LAL BAGH, INDORE, C. E. D. MEARS.
September 19, 1927.

[We are unfortunately able to reproduce only one of the photographs. EDS.]

XX.—AN EXAMPLE OF AN ASSISTED PASSAGE

On April 26, 1926, I sailed from Bombay in the S.S. *City of Exeter* which left about midday. About 3.30 p.m. I discovered that we had on board a single House-Crow (*Corvus splendens*) which had apparently failed to notice our departure in time. It looked rather bewildered at finding itself at sea, and grew more and more uneasy as dusk approached, launching out over the sea and then regaining the ship with difficulty. It was a dark dusky looking bird obviously of the typical race from Bombay, and not the pale *zugmayeri* which is the form at Karachi whence the *City of Exeter* had come.

The crow stayed with the ship for the next few days roosting on the rigging and receiving food and water by the good offices of the crew. We did not put in at Aden. We passed Perim on May 2 about 7–8 a.m. and after that I watched the bird making several attempts to fly towards the mainland which was visible. Its courage always failed however and it returned to the ship. By evening however it had disappeared and I was told that it had apparently flown on to another ship. Unfortunately this ship was steaming in the same direction as ourselves, or I might have told a good story about corvine sagacity in taking a ship back to India! As an observed example of how stragglers leave their habitat, this seems worth recording.

BATTLE, SUSSEX,
August 8, 1927.

HUGH WHISTLER,
F.L.S., F.Z.S.

XXI.—EXTRAORDINARY PUGNACITY OF THE RUSTY-CHEEKED SCIMITAR BABBLER (*POMATORHINUS ERYTHROGENYS*)

Last Sunday I went with a couple of friends for a jaunt in the car on the cart road in the direction of Tara-Devi. As it was a beautiful evening in the monsoons, we pulled the car up at the seventh milestone to admire the wonderful scenery, and above all the wonderful cloud effects that are only to be seen at this particular time of the year.

The country in the immediate vicinity is scrub oak. I happened to glance up the khud side, when I noticed two of the above-mentioned birds settle in a small oak tree about 90 feet above us. Keeping my eyes fixed on them, I noticed they were engaged in fighting. In a few seconds they both overblanced, and fell to the ground, and owing to the gradient of the steep hillside, they commenced rolling down the khud in our direction. So busily engaged were they in their fight, that they paid no attention to the car they were fast approaching. My friend Mr. Neville Cotton realizing he stood a chance of catching the birds, jumped out of the car, and stood with his hands ready open. On they came until they reached a stone wall about 10 feet high, which separates the road from the hillside. As they arrived at this point, they actually fell into the hands of my friend. On examining them I found that they still had no intention of giving up their fight, for one bird held the other's leg between his beak, while the other had a firm grip of his opponent's throat. It was no easy matter to separate them, anyhow after a little careful handling I managed to accomplish this, when both birds gave vent to their feelings by jabbing at my fingers. After their wrath appeared to have cooled down somewhat, I released them both, only to find they still had no intention of making friends, for all the trouble commenced afresh on a bush, about 100 feet down the khudside. A heavy mist soon obscured them from my view. Both birds were in deep moult. It would be interesting to know what all the trouble was about, and as I write this I wonder if they are still at it ?

THE MALL, SIMLA, ARTHUR H. BERRIFF.
July 25, 1927.

[As a rule, the best of good fellowship prevails among the babbler fraternity, though its members are susceptible to occasional paroxysms of violent rage when two or more members of a 'sisterhood' will go for one another with the utmost zest and fury. We have witnessed a somewhat similar incident to the one described by Mr. Berriff, the belligerents in this case being a couple of Bombay Babblers (*Turdoides somervillei*). An individual was seen furiously pursuing another on the ground over strewn foliage, stones and other impediments. They subsequently hopped on to a branch about 6 feet high whence they dropped in a tangle on the ground below lying on their backs and continuing to grapple fiercely with each other using bill and claws. We were able to approach near enough to cover the birds up with a sola topee without attracting notice.

They made good their escape, however, but no sooner were they out than the chase recommenced in all earnest.

A third bird here joined the fray and after the original opponents had come to grips and fallen to the ground a second time, the newcomer dropped perpendicularly on them and also got knotted up! Eds.]

XXII.—OCCURRENCE OF THE WOOD SNIPE IN THE CENTRAL PROVINCES

In February last, while shooting in the Mandla District of the Central Provinces, about five miles from Amarkantak, I saw a Wood Snipe (*Gallinago nemoricola*). Forsyth mentions having seen one once in the same district, otherwise I have never heard of the occurrence of this kind in the Central Provinces.

I should be interested to hear whether any other members of the Society have observed the species in the Provinces.

United Service Club,
Pall Mall, S.W. 1,
June 7, 1927.

J. Mc. C. CLIVE,
Captain, M.C.

XXIII.—NOTES ON DUCK SHOOTING IN THE ROORKEE DISTRICT, U. P., IN THE YEARS 1903 TO 1927

(*With a graph*)

1. The record extends over 21 seasons from 1903 to 1927, with three gaps of single years, in 1909–10, 1915–16 and 1923–24. The bags were all made in the jheels formed by the Solani R., close to its confluence with the Ganges R., about 15 miles S.E. of Roorkee, in the extreme N.W. of the plains of the U.P. (and some 35 miles S.E. of Saharanpur). In the great floods of September 1924, both the Solani R. and the Ganges R., were in exceptionally high flood, and as a result almost all the jheels were completely blotted out by being silted up by sand from the Solani R.; so that where there used to be 6 ft. and 8 ft. of water in a jheel there is now dry land with grass growing: this area will therefore never again be attractive to duck, unless indeed another cataclysm occurs similar to 1924. The duck shooting in this district is therefore now entirely ruined, and a thing of the past, as proved by the figures of the years since 1924: I have therefore thought that it may be valuable to record the figures now before it is too late (especially as a record extending over 21 seasons in the same district is not frequently obtainable), as they may be of value in the study of the distribution and migration of the various species of duck in India. For the past three seasons 1924 to 1927, I estimate there have never been more than some 500 duck in all the area of the former jheels, where prior to 1924 there used to be from 6,000 to 10,000 at least all through a season.

2. The figures given in my Table are taken from my game-book, written up in ink at the time. I have always been in the habit of vetting the bag carefully on return to camp each evening

and morning, and recording the numbers of each species separately in the game-book. Capt. E. E. Searight, R.E., has very kindly verified the figures in the Table with my original game-book.

The figures in the Table have been plotted as three curves on the Chart shown, for easier analysis. The bags were all made by 'flight shooting', i.e., on birds moving naturally to and from their feeding grounds at evening and morning, and without any driving, etc. The duck shooting 'season' has been taken as from September 15 to April 15, but as a rule very little good is done before November 1 or after March 1 as the main body of the migratory duck arrive in the Roorkee District between November 1 and 15 usually, and leave again by end of February. The first species to arrive in any numbers are the White-eyed Pochard, Gadwall and the Common Teal, and the last are Wigeon and the Red-Crested Pochard; the latter are often not 'in' till middle of December, and they are also the first to leave. The last species to leave are the Garganey Teal (who moreover do not arrive in this district in numbers till February, presumably on their way back from further south; they do not seem to come to the Roorkee district on their arrival in India); also the White-eye and Gadwall stay late, some few even till April sometimes.

The 'evening flight' for record purposes has been taken as from 3.30 p.m., till dark (about 6 p.m.); and the 'morning flight' as from dawn till 8.30 a.m. or 9 a.m.; though on misty mornings the birds will flight till as late as 10 a.m. Shooting in the middle of the day merely spoils the evening flighting, and never leads to anything of a bag. There is usually a big afternoon flight which goes on spasmodically between 3.30 p.m. and about 5 p.m., apparently birds stretching their wings after their mid-day siesta. And the real 'evening flight' lasts from about after 5 p.m., till well after dark, these being duck going to feed.

3. The figures in the Table present several points of interest; the years 1906–7, 1907–8, 1908–9 were all exceptionally good years; and so were 1918–19 and 1919–20; also 1914–15 was good: in these years unusual numbers of duck arriving in this district. This is well shown on the chart: the red curve of 'Total Bag' showing 'peaks' for these years, corroborated by the blue curve showing the average bag per 'flight': from the green curve it appears that big bags of over 50 per flight are more numerous in the years when duck are more plentiful, as one might perhaps expect. The years 1907, 1908 and again 1918 were exceptionally dry years, when the monsoon practically failed in the Roorkee area; so it seems as if in a dry year more duck come to India; though another explanation may be that in a dry year the smaller outlying jheels are dried up and so all the duck are concentrated in the larger and deeper places, such as the Roorkee jheels used to be prior to 1924.

The 27th column of the Table, giving the average bag per 'flight' in a season, shows that one's average expectation in the Roorkee District was about 29·68, say 30 birds, and cutting out the last three years, 1924–27, when the conditions had radically altered for the worse, it would be about 40 per flight. And the last line of the Table, showing the average numbers of each species, shows that in any bag one might expect to get 37 per cent. Gadwall, 13 per cent. Mallard, 11 per cent. White-eyes, 11 per cent. Common Teal and 7 per cent. of Red-crested Pochard : though of course any particular bag, owing to the nature of the place chosen as a stand, might consist almost entirely of one species, e.g., all Mallard with a few Common Teal if the place was in shallow water ; and all Red-crested Pochards if the water were very deep, with perhaps a few Gadwall.

4. Some points noted in my game-book that are not shown in the Table, are of interest as regards the dates the duck arrive and leave ; thus taking the different years :

1902–3 : On October 18 (i.e., early in season), a morning bag consisted of 12 White-eyes, 2 Common Teal, and 5 Cotton Teal.

1904–5 : On October 22 there were no duck ' in ' at all : on November 19 a bag of 43, showing the duck came in between those dates : on March 5 (late in season) a bag of 31.

1906–7 ; Was an exceptionally good season : between April 8 and 11 (very late). 4 Gadwall, 1 Red-crest Pochard, 2 White-eyes, and 13 Garganeys were got.

1907–8 : On November 8 birds were few, only 20 bagged : on January 27, 1908, all the Red-crests had left ; (very early). This was a very good season, and a very dry year.

1908–9 : On October 31 a bag of 24 : while 69 were got on November 1, so the birds came in early this year : this also was a very good season, and very dry.

1911–12 : On March 9 a bag of 40 : the duck were leaving, and the weather very hot.

1912–13 : A poor season : the Solani R. altered its course owing to big floods in 1912 monsoon.

1913–14 : A good season : on November 8 a bag of 19 only, birds not yet ' in ' properly ; on March 1 bag of 20, birds leaving fast.

1914–15 : On March 2 (full moon) three consecutive flights of 40, 41, 33 : In monsoon of 1914 the Solani R. altered its course radically and formed several new jheels : a good season.

1917–18 : On November 17 a bag of only 7 : birds not yet arrived ; this was very late : on March 23 only 3, birds having left : a very poor season with few duck.

1918–19 : A very good season with exceptional numbers of duck. 1918 was a very dry year with no monsoon : on November 9 a bag of 55, the birds being well ' in '.

1919-20 : On November 15 a bag of 101. A very dry year, with very little water in jheels.

1920-21 : On November 27 a bag of 91, this was also a very dry year with no rain after August 20, 1920.

1922-23 : On March 9 a bag of 92, very late in season for a big bag. Heavy monsoon in 1922, and heavy rain in February 1923.

1924-25 : A very bad year : In September 1924 exceptional floods in Solani and Ganges R., nearly all the Solani jheels were silted up solid, and no longer existed after the floods.

1925-26 and 1926-27 : Both very bad seasons : there were hardly any birds throughout both seasons, owing to there being no water area for them to settle on.

5. *Numbers of the different species.*—The last line of the Table (in bold type), gives the percentage of each species shot, on the average of the whole period of 21 seasons ; it is interesting to compare these figures given for the U.P., east (district not stated), in the Table on page 59 of D. Dewar's book *The Ducks of India* (1925 edn.) ; his figures are the number of each species occurring per 1000 birds shot. It may be here noted that Roorkee is in the extreme west of the U.P., and there seems to be a considerable difference in the numbers of some of the species occurring in the east and in the west of the U.P. : most notably in the case of the Red-headed (or Common) Pochard, and the White-eyed Pochard and Garganey Teal, and to a less extent with Gadwall, Pintail, Spotbill, and Common Teal.

Species	U.P. West (Roorkee) per 1000	U.P. East (Dewar) per 1000	REMARKS Roorkee Nos. compared to U.P. East Nos. are
Mallard ...	130	110	Rather more.
Gadwall ...	373	150	2½ times as many.
Red-crested Pochard ...	74	80	About the same.
Red-headed (Common) Pochard.	56	15	Nearly four times as many.
White-eyed Pochard ...	116	270	Much less than half the numbers.
Pintail ...	22	40	Half as many.
Shoveller ...	37	30	About the same.
Spotbill ...	14	6	Twice as many.
Wigeon ...	21	16	About the same.
Common Teal ...	119	200	About half as many.
Garganey Teal ...	8	50	Less than 1/6 the Nos.

In the Roorkee District, the Gadwall (37·3 per cent) are the most numerous species, being three times as many as any other kind. Next come Mallard (13 per cent), the White-eyed Pochard (11·6 per cent), Common Teal (11·9 per cent), Red-crested Pochard (7·4 per cent), Common Pochard (5·6 per cent)—then the Shoveller only 3·75 per cent; while, Wigeon, Pintail, are only about 2 per cent each, and Tufted Pochard and Spotbill only 1·45 per cent each.

In some years exceptional numbers of particular species seem to have occurred in the Roorkee District e.g.

Mallard (normal 13 per cent). In 1906-07, 17 per cent; and in 1908-9, 17 per cent were bagged.

Gadwall (normal 37·3 per cent). In 1906-7, 43·4 per cent; in 1919-20, 43 per cent: in 1920-21, 47 per cent; in 1921-22, 60 per cent; and in 1922-23, 47 per cent were bagged.

Pintail (normal 2·2 per cent). In 1907-8, 4·4 per cent; and 1918-19, 5 per cent.

Wigeon (normal 2·1 per cent). In 1911-12, 4·2 per cent; and in 1918-19, 4·3 per cent.

Red-crested Pochard (normal 7·4 per cent). In 1920-21, 15·3 per cent.

Red-headed (*Common*) *Pochard* (normal 5·6 per cent). In 1906-7, 8·5 per cent; in 1918-19, 9 per cent; and in 1920-21, 9·4 per cent.

White-eyed Pochard (normal 11·6 per cent). In 1908-9, 13·9 per cent.

Tufted Pochard (normal 1·45 per cent). In 1913-14 an exceptional increase of 10·4 per cent.

Common Teal (normal 11·88 per cent). In 1907-08, 20·3 per cent; and in 1918-19, 16·6 per cent.

Apparently in the exceptionally good (and dry) years, such as 1906-7, 1907-8, 1908-9, 1918-19 the Mallard, Pintail, Wigeon, Common and White-eyed Pochards, and the Common Teal, formed a bigger percentage of the bags than in more normal years: while the commonest duck, the Gadwall, formed an exceptionally large part of the bags in only two of the exceptionally good years (1906-7, and 1919-20), and then again in three consecutive seasons (1920 to 1923) that were not remarkable for large numbers of duck.

6. Some further notes on the commoner species in the Roorkee District.

Spotbill. There are always in every year a good many small parties (two to six) about during the whole season, and they probably remain all the hot weather. All I have shot were the common form (*Anas p. pœcilorhynca*).

Comb Duck. These are uncommon, but one saw one or two about in most years, early in the season only; though I shot a pair on January 11, 1915.

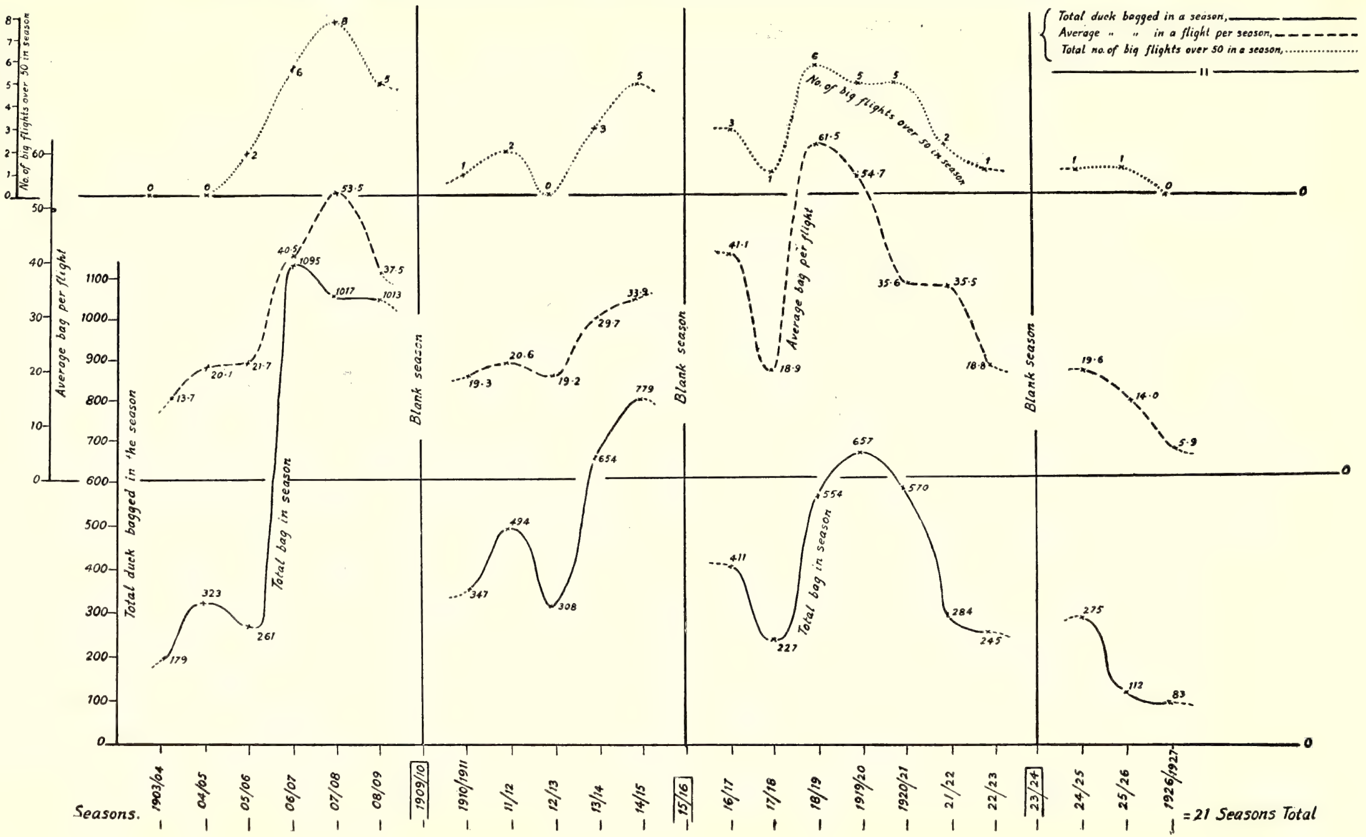
Cotton Teal. These are not common, but early in November; a few are seen about in most years; these appear to leave the district after November, presumably for the south.

Lesser Whistling Teal. Nearly every year I saw a few flocks about; which disappeared after end of November, presumably to go east or south. I never happened to bag any in the Roorkee District, but other guns bag a few most seasons, always early in the season.

Pintail. These are not numerous, but every year there are a few flocks all through the season.

Wigeon. Also not numerous, but occur every season; they come late (in December) and leave early (February).

Record of bags of duck made by flight shooting near Roorkee, U.P. in 21 seasons from 1903 to 1927, by Col: A. H. Cunningham.



EDISTRICT, U.P.

Big flights of 50 and over.						Total flights in season of and over
In November.	In December.	In January.	In February.	In March.	Total in season flights of 50 and over.	
...	...	...	...	...	...	...
...	...	...	...	...	...	...
...	...	...	...	...	...	...
...	1	1	...	...	2	...
...	2	3	1	...	6	...
5	2	1	...	...	8	1
1	4	...	...	...	5	...

TABLE SHOWING DETAILS OF BAGS OF DUCK MADE BETWEEN 1903 & 1927 IN THE ROORKEE DISTRICT, U.P.

Duck shooting 'season' taken as September 15 to April 15	Geese.			Surface feeding Duck.									Diving Duck.					Teal.									Big flights of 50 and over.									Remarks.
Season	Grey-Lag.	Bar-headed.	Others.	Comb Duck or 'Nukhta'.	Brahminy.	Mallard.	Spotbill.	Shoveller.	Pintail.	Gadwall.	Wigeon.	Lesser Whistling Teal.	Red-crested Pochard.	Common Pochard or Red-headed P.	White-eyed Pochard.	Tufted Pochard.	Golden-eye (*Glaucionetta clangala.*)	Common Teal.	Garganey Teal.	Falcated Teal (*Eunetta falcata.*)	Cotton Teal	Other Duck.	Smew.	Total Duck (and Smew) bagged in season.	Number of flights in season.	Average bag per flight.	In November.	In December.	In January.	In February.	In March.	Total in season of flights of 50 and over.	Total flights in season of and over	Biggest bag in season.	Dates of bagging uncommon species of Duck.	m= Morning 'flight', dawn (6 a.m.) till 9 a.m. e= Evening 'flight', from 3.30 p.m. till dark (6 p.m.)
1894–1895	...	...	...	...	...	43	2	2	...	69	...	...	90	...	61	...	...	11	...	...	...	...	...	278	21	13·2	...	...	...	...	...	...	...	29	...	*N.B.*—FIGURES OF THIS YEAR '94/95' NOT INCLUDED IN TOTALS BELOW.
1903-1904 ...	..	...	...	...	2	46	4	1	...	65	5	...	37	1	3	2	...	12	...	...	*1	...	...	179	13	13·7	...	...	...	..	...	...	...	28	* 6-12-03	......
1904-1905 ...	...	...	...	φ1	1	10	3	5	6	128	3	...	18	34	80	2	...	32	...	...	...	...	...	323	16	20·1	...	...	...	...	...	...	...	49	φ19-11-04	......
1905-1906 ...	..	...	...	..	3	85	1	6	11	3	2	...	29	46	11	...	...	64	...	...	...	...	...	261	12	21·7	...	1	1	...	...	2	...	62	......	......
1906-1907 ...	2	...	...	φ1	2	172	11	62	6	423	6	...	72	93	107	9	...	112	15	...	*1	...	‡3	1,095	27	40·5	..	2	3	1	...	6	...	78	φ29 12-06 *12- 1-07 ‡28-12-06	A very good season.
1907-1908 ...	3	...	...	...	7	42	7	60	45	442	13	...	39	53	88	14	...	207	...	...	...	...	...	1,017	19	53·5	5	2	1	...	...	8	1	§156*e*	......	A very good season—a very dry year. § *Local record flight* till 1919—made on evening of November 15, 1907.
1908-1909 ...	23	2	..	...	5	179	8	43	25	347	5	...	72	52	141	14	...	116	4	...	...	§1	†1	1,013	27	37·5	1	4	...			5	..	70	§29-12-08 †14- 2-09	§ Species not recorded. A very good year.
1910-1916 ...	...	..	...	...	5	22	4	11	1	132	7	...	65	10	25	...	♀1	52	11	...	...	...	†1	347	18	19·3	...	1	.	...	..	1	...	63	♀20- 2-11 †30-12-10	Only 18 days in December, January and February.
1911-1912 ...	...	...	...	...	7	56	2	14	1	171	21	...	70	20	63	14	...	47	8	..	...	...	...	494	24	20·6	...	2	...	...	...	2	...	73	......	......
1912-1913 ...	...	...	...	...	...	39	...	11	12	57	4	...	21	36	105	7	...	14	2	...	...	...	...	308	16	19·2	...	...	...	...	...	...	...	40	......	Heavy floods in February, 1913, and Solani R.—attend its course. Only ½ season after January 1, 1913.
1913-1914 ...	24	...	...	...	3	93	9	49	26	209	19	...	11	51	79	37	...	65	3	...	.	...	...	654	22	29·7	..	..	3	...	...	3	...	85	......	......
1914-1915 ...	1	...	...	φ2	8	34	23	28	3	284	22	...	67	7	113	12	...	160	15	♂1	...	...	...	779	23	33·9	...	1	1	3	...	5	...	70	φ11-1-15 ♂31-1-15	......
1916-1917 ...	...	...	...	...	7	56	1	8	4	151	19	...	62	11	69	1	...	19	1	♂1	...	...	†1	411	10	41·1	...	...	3	...	...	3	...	65	♂28-1-17 †27-1-17	Only ½ season, after January 1, 1917.
1917-1918 ...	...	...	...	...	2	59	2	3	1	90	10	...	26	2	13	2	...	15	2	...	...	...	...	227	12	18·9	...	1	1	...	...	1	...	57	......	......
1918-1919 ...	...	...	...	...	1	81	17	23	28	202	23	...	5	50	27	5	...	92	...	...	...	...	...	554	9	61·5	4	2	...	...	...	6	2	135*e* 100*e*	......	Very dry year, no monsoon, exceptionally good season. Only shot ½ season, up to December 7, 1918.
1919-1920 ...	1	...	...	...	5	148	3	18	13	282	21	...	6	26	74	4	...	53	...	..	*4	...	...	657	12	54·7	4	...	1	...	...	5	2	*168*m* 101*e*	† 16-11-19	A very good year—very dry, no monsoon hardly. † *Local record* up to 1927—bag made morning of November 23, 1919.
1920-1921 ...	1	...	...	...	5	67	3	4	4	267	16	...	87	54	33	4	...	26	...	...	...	...	...	570	16	35·6	1	1	2	1	...	5	...	91	......	.. ...
1921-1922 ...	...	...	...	...	5	19	9	8	14	173	3	...	7	2	1	...	...	41	2	...	...	...	...	284	8	35·5	...	1	...	...	1	2	...	92	......	......
1922-1923 ...	...	...	...	...	4	60	10	14	3	115	1	...	3	2	10	4	...	18	1	...	...	...	...	245	13	18·8	...	1	...	...	...	1	...	65	......	Exceptional floods in Ganges and Solani R. in September 1924 and most jheels silted up altogether.
1924-1925 ...	1	...	...	...	9	17	18	...	14	104	5	...	15	3	53	2	...	24	11	...	...	...	...	275	14	19·6	...	...	...	1	...	1	...	62	......	A bad season with few birds.
1925-1926 ...	...	...	...	...	2	3	4	2	3	47	4	...	13	1	27	3	...	2	1	...	...	...	...	112	8	14·0	...	1	...	...	...	1	...	53	......	Very bad season—only shot ½ season up to December 28, 1925.
1926-1927 ...	...	...	...	...	...	7	5	1	2	6	2	...	13	1	32	4	...	6	4	...	...	...	...	83	14	5·9	...	...	...	...	...	...	...	21	......	Exceptionally bad season—no birds at all.
Totals	56	2	...	4	83	1,295	144	371	222	3,698	211	...	738	555	1,154	140	1	1,177	80	2	6	1	6	9,888	333	29·68	15	19	16	6	1	57	5	...	......	*N.B.*—Geese are not counted in Total bag of season in Col. 25 opposite—not in the percentages
Average percentage of species.	...	...	...	·04	·84	13·08	1·45	3·75	2·24	37·34	2·13	...	7·45	5·61	11·65	1·44	·01	11·88	·808	·02	·06	·01	·06	100·00	...	...	...	...	...	...	...	...	...	...	.. ...	......

Notes.—All the Spotbill shot were the common one (*Anas pipoccilorhynca*).
All the White-eyed Pochard were the western form (*Nyroca n. nyroca*).
The Golden Eye ♀, and the 2 Falcated Teal ♂ were all sent to Bombay, and verified by the Bombay Natural History Society.
Though no Lesser Whistling Teal were actually bagged, one or two flocks were generally seen each year in November—(leaving for the south at end of November)—and a few bagged each year by other guns.
Specimens of following species were bagged near Roorkee between 1892 and 1905 by other guns to my knowledge—Stiff-tailed Duck (*Oxyura leucocephala*)—Marbled Duck (*Marmaronetta angustirostris*).
The scamp (*Nyroca m. morila*).

Notes.—The figures for the year 1894-1895 are only given for comparison, and are not included in the totals at bottom of page, or in the average of species, as the year was distant from the series of twenty-one years, 1903–1927.
The figures are taken from my Game Book, kept in ink, and written up daily—I have always vetted the species bagged immediately on reaching camp, evenings and mornings.
All the duck were shot by 'flight shooting,' as the birds flighted naturally to their feeding grounds morning and evening.

Compared with Col. Cunningham's original Game Book.
E. E. G. SEARIGHT,
Capt., R.E.,
April 15, 1927.

A. CUNNINGHAM,
Colonel,
April 20, 1927.

Shoveller. These are fairly numerous in the jheels every season, occurring in scattered parties.

Red-crested Pochard. These occur every season, the big flocks arrive late (in December) and leave early. Owing to their occurring in big flocks, a big bag is often largely of this species.

Red-headed (*Common*) *Pochard.* Some come every year ; but they are variable in numbers from season to season, much more so than the Red-crests.

White-eyed Pochard. Is common every year and ubiquitous in the jheels : they come earliest of the migratory duck, and leave late : all I have shot have been the western form (*Nyroca n.nyroca*).

Tufted Pochard (*Nyroca fuligula*). These are never numerous ; but a few small flocks come every season.

Brahminy. Quite a few of these are always about in the jheels, though they are much more numerous in rivers such as the Ganges.

Common Teal. These are ubiquitous and common every year ; this year however, 1926-27, it was noticeable that there were hardly any.

Garganey Teal. Very few of these appear till February ; presumably on their return migration from the east ; they are then fairly common ; and stay last of the duck.

The Smew. A few scattered individuals occur most years.

The Goosander. I have never seen these in the jheels, but have shot them in the Ganges R. near Hardwar, where they are fairly common.

Geese. Both the Grey-lag, and the Bar-headed Geese occur in small numbers in the jheels in most years : the former being far more common than the latter.

7. The following duck are very rare in the Roorkee district :—

Golden Eye (*Glaucionetta clangula*). I shot one on February 20, 1911, and sent it to the Bombay Natural History Society for verification.

Falcated Teal (*Eunetta falcata*). I shot one on January 31, 1915, and one on January 28, 1917, both were sent to the Bombay Natural History Society for verification.

Common Sheldrake (*Tadorna cornuta*). I saw two of these birds flying with and leading four Brahminies, unfortunately my shot brought down the third bird in the line, a Brahminy ! ! so I was unable the make certain : but I am certain they were Common Sheldrake (of which I have shot several in Sindh), as the birds were well in shot and the light was bright, about 8 a.m.

Marbled Teal (*Marmaronetta angustirostris*).

Stiff-tailed Duck (*Oxyura leucocephala*).

The Scaup (*Nyroca m. marila*).

Specimens of these last three have to my knowledge been shot in the Roorkee jheels by other guns between the years 1892 and 1905.

ROORKEE, U.P.,
April 20, 1927.

A. H. CUNNINGHAM,
Colonel.

XXIV.—SNIPE AND WOODCOCK IN S. INDIA.

The following extracts from my Game Registers of the last four seasons, showing the different varieties of Snipe, and the number of Woodcock shot, may be of interest :—

Locality	Year	Month	Fantail	Pintail	Swinhoe	Wood Snipe	Jack	Painted	Remarks.
Ootacamund ...	1923-4	...	1	97	...	...	1	...	First shot Ocotber 19.
,, ...	1924-5	...	...	53	...	...	...	...	Last shot February 22.
,, ...	1926-6	...	...	48	...	1	...	...	First shot September 28. Last shot February 19. Wood Snipe January 2.
,, ...	1926-7	...	...	97	...	2	...	...	First shot September 23. Last shot March 5. Wood Snipe January 29.
Cannanore ...	1925	Dec.	18	53	2	...	...	...	...
,, ...	1926	Feb.	10	42	...	...	...	...	...
,, ...	1926	Nov.	23	130	1	...	2	2	...
,, ...	1927	Jan.	38	134	...	...	3	11	...
S. Mysore ...	1926	Jan.	23	30	...	...	...	4	...
,, ...	1926	Oct.	6	35	...	...	...	1	...
,, ...	1926-7	Dec.-Feb.	15	8	...	...	1	...	...

Locality	Year	Woodcock	1st shot	Last shot	Best day	Remarks.
Ootacamund ...	1923-4	14	Nov. 5	Jan. 26	3	Stopped shooting on January 26.
,, ...	1924-5	27	Dec. 12	March 9	5	...
,, ...	1925-6	14	Dec. 16	Feb. 19	7	A poor year.
,, ...	1926-7	24	Dec. 11	March 2	4	...

NOTES

Ootacamund.—Fantails are distinctly rare on the Plateau ; in fact, the one shot in 1923 is the only one I have heard of for some time. Wood Snipe are commoner in the Wynaad than up here, where only four or five are shot each season. I send for reference the wing of one shot last January.

Cannanore.—Pintails largely predominate ; occasionally one of the larger variety is noticed, e.g. six during 1927. I send for reference the tail of the last Swinhoe shot.

S. Mysore.—The Fantails included several more or less typical specimens of Radde's snipe, but unfortunately no record of them was made at the time.

Woodcock.—These seem to come in later than formerly, possibly visiting the Anamalais before arriving here. February is the best month and nearly all are gone by March 15, or earlier if heavy rain falls. I think 25 to 30 may be considered a good average season's bag, it being remembered that small game shooting on the Plateau is limited to two days a week. Three woodcock weighed on January 5, i.e. well in the season, were 10, 11 and 11 oz. respectively.

LOVEDALE, E. G. PHYTHIAN ADAMS,
NILGIRIS, *Major*, *I.A.*, (Retd.)
June 1, 1927.

XXV.—A CORRECTION TO MR. B. B. OSMASTON'S 'NOTES ON THE BIRDS OF KASHMIR'

In Vol. xxxi, part 4 of our Journal, Mr. B. B. Osmaston has commenced a series of very valuable and interesting notes on the birds of Kashmir. He will perhaps forgive me for venturing to correct two of his identifications, as mistakes quickly gain currency and are endlessly repeated.

No. 75, *Acrocephalus concinens concinens.*—The Chinese Paddy-field Warbler.

A Paddy-field Warbler has been known to breed in Cashmere ever since Brooks first found an empty nest at Shupyion on June 13, 1871, and shot the male bird which is still in the British Museum. Yet though we have for some years known it to be common and Rattray, Wilson, Davidson, Bates and others have collected numbers of the nests and eggs, we cannot get its name right. In the last edition of the Fauna we find it shown under two species *Acrocephalus agricolus* (which may nest in Turkestan or the plains of India but certainly does *not* nest in Cashmere), and *A. concinens concinens* (which in my opinion does not occur anywhere in Indian limits). It remained however for Mr. Osmaston to collect a proper series of skins though owing to his departure for Africa he was unable to examine them critically and merely accepted the identification given in the Fauna. I have seen his series and also various other birds collected in the Cashmere jheels in the breeding season, 17 in all. I have no hesitation in saying that these birds agree with Harington and Whitehead's series in the British Museum from the Kaghan Valley, the type locality for *Acrocephalus concinens haringtoni*, which is therefore the correct name for the Paddy-field Warbler which breeds so commonly in Cashmere.

No. 77. *Sylvia curruca affinis.* Indian Lesser White-throat.

Both Dr. C. B. Ticehurst and myself have endeavoured for some years past to dissipate the legend that this species breeds within Indian limits, but it is repeated again and again like the mistakes over the Paddy-field Warbler. Mr. Osmaston kindly gave me two White-throats collected by him in the Suru Valley to identify his eggs. These are both specimens of *Sylvia althœa*, Hume's Whitethroat which is really the breeding Whitethroat of Cashmere. It will be noticed in Colonel Meinertzhagen's account of his trip to Ladakh (*Ibis.*, 1927, p. 421) that he found *S. althœa* to be the common breeding bird of the Indus, Shyok and Nubra Valleys. Mr. Osmaston's mistake was of course due to his hurried departure for Africa before he could make a fresh examination of his skins, but I can only end by urging that for the present no egg collector in India, Cashmere or Baluchistan will name any Whitethroat's eggs without a skin from the nest to support his identification.

CALDBEC HOUSE, HUGH WHISTLER.
BATTLE,
August 30, 1927.

XXVI.—AN ALBINO TURTLE

On June 25, I secured a specimen of the Common Mud Turtle of these parts, *Emyda granosa intermedius*, Annandale, which is apparently an albino. It was a half-grown specimen and was bright yellow throughout with the exception of the limbs and neck which were chrome yellow. The plastron had the usual colourless appearance. It was taken in the Ambajheri Tank at Nagpur and is deposited in the Nagpur Museum. (Reptile No. 274.)

NAGPUR, C. P., E. A. D'ABREU, F.Z.S.
August 17, 1927.

XXVII.—NOTES ON THE DESERT MONITOR (*VARANUS GRISEUS*) AND THE SPINY TAILED LIZARD (*UROMASTIX MICROLEPIS*)

The following field notes may be of interest: they have been compiled from observation and the experience of Bedouin hunters. Most of the facts were obtained from Nahaita, an Araif tribesman, who has spent most of his thirty years or so of life hunting the wild animals of the Shamiyah Desert, and Radam, who has had a similar career. For their truth I cannot vouch, but both men are now in the Camel Police and are models of reliability when reporting, and of observation and knowledge when anything relating to the local stretches of Iraq and Najd is under discussion.

The Desert Monitor (*V. griseus*) locally known as the *harwhal*, ranges in adults from twelve to twenty inches in length. It is so called because it is never seen travelling at any other pace but that of a fast wriggling run. I have myself, however, seen them travelling at what could only be termed a slow stumbling crawl but this was in about twelve square feet of confinement.

They are easily overtaken by a running man. When neared, they stop, turning their heads with mouths wide open in the direction of their pursuers. They then lash their tails furiously from side to side and shoot their tongues in and out at the same time hissing loudly. If foot or stick is approached more closely to them, they will make sudden darts snapping fiercely at the offending object, and although the only result is bleeding and broken teeth, they persist in doing the same thing repeatedly.

I have found that the best way to catch them is by a sharp kick under the belly which bowls them over, a foot placed quickly on the head then enables one to pick them up by the tail when a noose may be easily passed over the head and up to the waist. I have never seen them biting the line that holds them captive.

These reptiles are found in the Shamiyah Desert and also in the Gizerah region between the Tigris and Euphrates. They prefer sandy places especially with mounds or undulations, and it is only when these are present that they are found in Subakha, a salt mud of treacherous consistency found in patches of varying size in the local desert.

Though they sometimes dig their own burrows, they more usually adopt the disused holes of other animals such as rats and jerboas. When its own excavation, the shaft is driven in at an angle of about forty-five degrees to a distance of roughly eighteen inches, the sunken end being expanded into a chamber. The outlet remains single.

They are said to feed on the surface only, never taking food below ground. No vegetation is eaten and they dislike water. Their food consists of crickets, small lizards and local desert snakes.

Of the pairing of the *harwhal* nothing is known, they are always seen single. The female is similarly coloured to the male, that is with straw coloured belly, and back of a greenish-grey ground with darker mottling. The belly of the male I have noticed has a pinkish tinge in early summer. The female is slightly smaller.

It is said not to hibernate, and as a fact is seen much more frequently in winter all day long than in summer when it is seen in early morning and late evening only. It apparently objects to more than moderate heat and this is borne out by its behaviour in captivity. At night and when not directly under the sun's rays it lay contentedly in the centre of its cage, but when the sun shone directly upon it, great unrest was evinced and it was not happy until a crack or cranny had been found into which at least its head might be pushed.

It is not venomous. I have been bitten and so has my spaniel. There was a very small puncture, little blood and no subsequent reaction of any sort. It is not eaten by the Arab.

The eggs are laid in the burrow chamber and number fifteen to thirty. They are described as being of the size of a pigeon's egg and are white spotted with brown. The young are similar in colour and appearance to the adult.

Both belly and throat swell when the animal hisses, the maximum of hiss and swelling occur together.

The only folklore obtainable was, that the tribes say that if the teats of goats and ewes are found swollen, the recent pastures are searched and a *harwhal* is invariably found in the vicinity. They say that it hangs on to the teats and drinks the milk. The tribes admit that no teeth marks are ever found. In captivity they do not touch milk.

The 'thub' or Spiny-tailed Lizard (*U. microlepis*) has the head of the ordinary lizard to the eye of the lay observer, but its body is almost as broad as it is long. The tail is relatively short but tremendously thick and carries fifteen to twenty horny spikes which project backwards and slightly outwards from the main stem. I cannot appreciate its utility; as a weapon it is absurd, and as a boring instrument if it is true that the 'thub' burrows head first, it is at the wrong end of the machine.

My informants say that it gets its name from its never moving from the one place. It is found all over the Shamiyah Desert but only where stony outcrops occur and is not found at all in the Gizerah.

Its burrow descends vertically in a medium spiral to a depth of about four feet, a horizontal off-shoot near the surface in the female burrow containing the eggs. The burrows are occupied singly and have one outlet.

Unlike the *harwhal* the 'thub' eats vegetation but of no particular sort. It also eats crickets and it is generally averred that the female thub watches her eggs hatch not from maternal solicitude but in order to eat them.

They hibernate in December and January and are much slighter in February.

They breed in April and May. The female is said at this season to protrude her rear half from her burrow at the same time slowly waving her tail. This attracts passing males who signify their presence by hissing. Hunters often catch a female thub by approaching gently while she is thus employed and imitating the hiss of the male. The female leaves her hole and is then an easy capture. Coitus is by ventral apposition; the pair do not associate for a time longer than is necessary for the act. Most males are darkly coloured similar to the *harwhal* but there are some much lighter. All females are light.

The eggs which are white are thirty to forty in number and are compared in size and shape to small dates. They are laid in the female's burrow and as stated previously are hatched for the table. Whether she eats only a proportion or all that cannot escape is unknown. Both reptiles and eggs are eaten by the Arab.

They are not venomous, and ripe old age, longer than man, is said to be their destiny if they escape the desert hunters. The commonest method of catching them is to pour water down their holes when they promptly emerge.

Their throats and bellies distend when they hiss as in the *harwhals.*

NASIRIYAH,
IRAQ,
September 9, 1927.

NORMAN L. CORKILL.

XXVIII.—HAMADRYADS IN THE KUMAON TERAI

I saw two hamadryads in my shooting block. Neither of them seriously showed much fight. The first one made off through jungle; I was within 10 yards of it when first seen.

The second was in my back verandah. I heard a curious swishing noise while having tea at 4.30 p.m. and on looking out of the window saw a huge hamadryad slowly moving along the back verandah. I called up the servants and we threatened it with sticks and it made off rapidly. We threw big stones and one caught it on the back, drawing blood. It reared up about 3 feet or more, expanding its hood, but did not drive home its attack and finally went up a bushy tree 15 feet off the ground. Meanwhile my man brought a shot-gun and I shot it through the head. It measured 13 feet.

I may say that I saw two hamadryads last year in a block in the Siwaliks and neither of them showed fight. One we killed, the other was lying beside a stream when I came on it in the early morning while out after a chital. It swam the stream like greased lightning and disappeared.

AJMER,
July 8, 1927.

W. M. LOGAN HOME,
Major,
4th Bombay Grenadiers.

[While the belief that the Hamadryad will attack human beings with or without provocation is widely current, authentic records of its doing so are extremely rare. In the majority of instances this snake, like others of his kind, seeks safety in flight. EDS.]

XXIX.–MR. SLATER'S DEATH BY SNAKE BITE

Some months back you published in your Journal my letter regarding the above, in which I stated that it was a well-known fact in these parts that the snake which bit Mr. Slater of the Geological Department was a King Cobra or Hamadryad. I gave the facts as stated to me by the Range Forest Officer who was at that time in charge of the Thirthahalli Range in the Shimoga District where this incident took place. In a later issue of the Journal Mr. R. C. Morris of Attikan Estate, Mysore District, contradicted my statement, and said that it was not a King Cobra but a Russel's Viper which bit Mr. Slater and caused his death. I am sorry I was not able to reply to this contradiction earlier as I have only now been able to get authentic confirmation of my previous statement.

MYSORE, S. INDIA,
September 27, 1927.

CHARLES THEOBALD.

[Mr. Theobald forwards us letters received by him from the District Magistrate, Shimoga, the Director, Mysore Geological Department, and the District Forest Officer, Shimoga. Though none of these officials were present at the time of the occurrence they conclude from the reports gathered at the time that the snake which caused Mr. Slater's death was a ‘ Kalinaga ’ which according to Mr. Theobald is the local name for Hamadryad. EDS.]

XXX.—A NOTE ON THE GREEN WHIP SNAKE (*DRYOPHIS MYCTERIZANS*) AND YOUNG

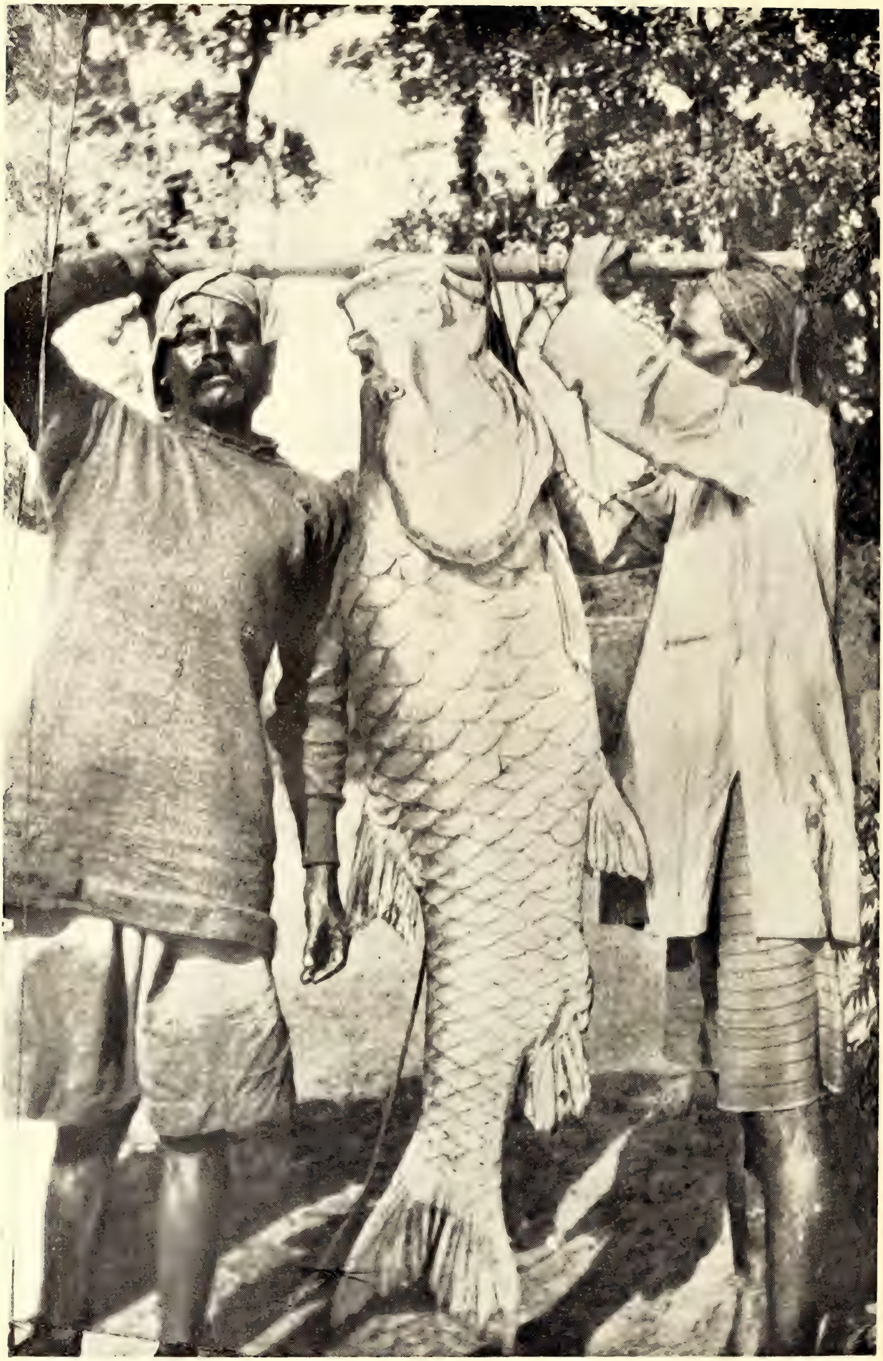
(*With a photo*)

A short while ago we received in the Society's office two consignments of this beautiful and perhaps the most graceful of our Indian snakes. Among them were a few gravid females. About two weeks after their arrival one of them presented us with fourteen young, twelve of which are alive and vigorous, one was born dead while the last was expelled still enveloped in the fœtal membrane. They were born during the night of September 5 and were discovered the next morning.

The mother taped 1262·5 mm. and the average length of the young, taken approximately twelve hours after birth, was 345 mm., the longest was 368 mm. and the shortest was 339 mm.

In general colouring they are like the parent except that the longitudinal line on either flank is white instead of yellow. There is a distinct white line over the upperside of the orbit which travels forward along the angle of the snout to the tip. This is apparently a juvenile character as it is not present in the adult specimens. The only yellow marking is a short line running backwards from the base of the orbit to the point where the head is differentiated from the body.

The first slough as is customary with snakes took place soon after birth.



The Record Cubbany Mahseer.
Weight 105 lbs.

The specimens were measured four days after and though they had had no food, showed an average length of 361 mm.—an average increase of 16 mm. The longest measured 379 mm. and the shortest 342 mm.

On a former occasion a specimen which I had in captivity gave birth to twenty-three young, seventeen of which were alive and the others born dead. On this occasion also they were born during the night.

It is unfortunate that these snakes cannot be kept for any great length of time in captivity as feeding them is a very difficult matter, and though they endure a long time without food they soon begin to look miserable and emaciated. They would perhaps live if they could be kept in a large cage and given a supply of small birds and mice from time to time.

The accompanying photograph shows a number of these creatures in one of our cages.

BOMBAY NATURAL HISTORY SOCIETY,
6, APOLLO STREET, C. McCANN.
September 13, 1927.

[The mass of snakes shown in the photo were part of two consignments of snakes sent from Hyderabad, (Deccan), to Delhi and intercepted *en route* by the postal authorities who, though they tolerate most things, draw the line at live snakes. The sender collected about 280 of these snakes for despatch through the post from which we may conclude that the green Whip Snake is very common in the neighbourhood of Hyderabad. EDS.]

XXXI.—THE RECORD CUBBANY MASHEER

(*With a plate*)

The mighty Masheer shown in the accompanying plate was taken from the Cubbany River, South India (for which it is a record), on November 6, 1926. It was landed in about 40 minutes using a Hardy 16 ft. split cane Hi-Regain rod, cutty-bunk line of 40 lbs. breaking strain and Alcock's special single hook.

Weight	105 lbs.
Length	5 ft. 4 in.
Girth	3 ft. 2 in.

KIRKEE, G. A. HARE,
August 1, 1927. *Lt.-Col.*

[Col. Hare has very kindly presented the skin of this magnificent fish to the Museum of the Bombay Natural History Sociory. EDS.]

XXXII.—AQUATIC RHYNCHOTA IN THE COLLECTION OF THE AGRICULTURAL COLLEGE, COIMBATORE. S. INDIA

(Published with the permission of the Director of Museums, S.S. and F.M.S.)

Rao Sahib Y. Ramachandra Rao, Acting Government Entomologist, Coimbatore, has very kindly entrusted the collection of aquatic Rhynchota in his care to me for identification. Though there is nothing of outstanding interest among this material, the following list of the species contained in it seems to be worth publishing, as it adds considerably to our knowledge of their geographical distribution. All these species, with the exception of the first, are described by Distant in his volumes in the *Fauna of British India* series.

Family HYDROMETRIDÆ

1. **Hydrometra greeni**, Kirk. Coimbatore, 'at light'. (Coll. *Y.K.* December 11, 1914).

According to Bergroth (*Zool. Med.*, i, 2, p. 118, 1915) *H. greeni*, Kirk. is quite distinct from *H. lineatus*, Esch. (described by Distant as *H. vittata*, Stal.), though Distant and others have regarded it as a synonym, his opinion being based chiefly on the male genital segments. A conspicuous character, however, is that the whitish hemelytral vitta is broadly fuscously interrupted about four to six times, while in *H. lineatus* it is only narrowly interrupted behind the middle by two transverse veinlets. As the examples before me are females, I have based my identification mainly on this character. J. R. la Torre-Bueno (*Spolia Zeylanica*, xiii, 2, p. 226, 1925), who does not appear to have noticed Bergroth's work, also regards *H. greeni* as a distinct species, though he does not give very definite reasons for his opinion. *H. greeni* is a common Ceylonese insect.

2. **Gerris anadyomene,** Kirk. College Farm, Coimbatore. (Coll. *St. S.V.*, October 11, 1916).

This is another common Ceylonese species, which may be expected to occur in S. India.

3. **Gerris adelaidis,** Dohrn. Pulney Hill, 5,000–6,000 feet. (Coll. *P. S. Nathan*, May 10, 1917).

The specimen before me agrees exactly with the description given by Distant, the semi lunate basal marking on the head being very characteristic. This species is related to *G. paludum* and *G. spinolæ* and would come in Distant's generic section C. It seems to be a little known form of which further material would be useful.

4. **Onychotrechus vadda**, Dist. Pulney Hill, 5,000–6,000 feet. Coll. (*P. S. Nathan*, May 10, 1917).

5. **Cylindrostethus productus**, Spin. Cauvery Bed, Trichinopoly. (Coll. *P. S. Nathan*, March 20, 1918).

6. **Ptilomera laticaudata**, Hardw. Coimbatore.

7. **Metrocoris stali**, Dohrn. Dodabetta, Nilgiri Hills, 8,000 feet.

Family NEPIDÆ

8. **Laccotrephes ruber,** Linn. Wynad, Malabar ; Ponanosat, Tanjore District.

9. **Laccotrephes griseus,** Fabr. Guindy, Madras (Coll. *Fletcher*, August 17, 1913) ; Coimbatore (Coll. *Fletcher*, May 13, 1913 and November 27, 1913 (Coll. *C. K. S.*, March 27, 1915) ; Yemmiganur, Bellary District (Coll. *C. N.* December 24, 1912) ; Sirugappa, Bellary District (Coll. *D. P.*, November 28, 1912).

10. **Ranatra elongata,** Fabr. Peermade, Travancore (Coll. *R. S. V.* April 21–28, 1918) ; Coimbatore (Coll. *Y. R.*, May 18, 1918).

Family, BELOSTOMATIDÆ

11. **Sphærodema rusticum,** Fabr. Mathimudongudem, Kistna District ; Coimbatore ; Sewage Farm, Madras (Coll. *Fletcher*, August 1913).

12. **Belostoma indicum,** Lep. and Serv. Kinavallore, S. Malabar (Coll. *P. S. Nathan*, June 15, 1918) ; College Farm, Coimbatore.

Family NOTONECTIDÆ

13. **Enithares indica,** Fabr. Coimbatore.

14. **Enithares triungularis,** Guer. Peermade, Travancore (Coll. *Isaac*, April 21–28, 1918).

15. **Anisops sardea,** Herr. Schaff. Coimbatore, ' at light '.

16. **Anisops niveus,** Fabr. Peermade, Travancore (Coll. *Isaac*, April 21–28, 1918).

c/o F.M.S. MUSEUM,
KUALA LUMPUR,
F.M.S.

CEDRIC DOVER.

PROCEEDINGS

Proceedings of the Meeting held on September 27, 1927.

A meeting of Members of the Bombay Natural History Society and their friends took place on Tuesday, September 27, at 6.30 p.m., at the Prince of Wales Museum. Mr. H. A. W. Brent presiding.

NEW MEMBERS

The following 51 members were elected since the last meeting:—Mr. F. C. Petit, Bombay; Mr. Ishwardas Lukhmidas, Bombay; Mr. Lakhmidas G. G. Tejpal, Vile Parle, Bombay; Mr. A. P. Neatham, Bombay; Mr. Hooseinbhoy A. Lalljee, Bombay; Sir R. N. Mookerjee, K.C.I.E., K.C.V.O., Calcutta; Mr. A. W. John, Chittavarrai, S.I.; Mr. S. C. Petit, Bombay; Mr. S. C. Barooah, Assam; The Principal, Deccan College, Poona; Mr. Sultanbhoy Bajeebhoy, Bombay; Mr. A. K. Kothare, Bombay; Mr. H. B. Guzdar, Bombay; Mr. C. H. Phillips, Assam; Mr. E. R. Grant, Washington, U.S.A.; Mr. P. M. Dalal, Bombay; Mr. J. Burke, Bombay; Mr. E. C. Benthall, Calcutta; Sir Onkar Mull Jatia, Kt., O.B.E., Calcutta; The Principal, Maharaja's College, Ernaculam, S.I.; Mr. J. N. R. Mehta, Karachi; Mr. R. G. J. Crisp, Itarsi, C.P.; Mrs. A. J. Leech, Madras; Sir Cowasjee Jehangir (Jr.) Kt., K.C.S.I., C.I.E., Poona; Mr. B. S. N. Cooper, Bombay; The Yuvaraj of Limbdi, Limbdi, Kathiawar; Mr. Kaikhosru N. Chandabhoy, B.A., F.A.A., Bombay; Major E. A. Breithaupt, Hyderabad, Deccan; Dr. F. E. Davar, L.D.S., R.C.S., L. M. & S., J. P., Bombay; Mr. Ebrahim Dawood Kazi, Bombay; Mr. C. E. Hewetson, I.F.S., Bombay; The Principal, Mrs. A. V. N. College, Vizagapatam; Mr. A. G. C. Elliott, Kishtwar, Jammu; The Librarian, Osmania University College Library, Hyderabad, Deccan; Mr. D. N. Bahadurji, Bombay; Mr. T. T. Kothavala, Dhulia; Mr. Hoshang N. E. Dinshaw, Karachi; Mr. Fakirjee Cowasjee, Karachi; Mr. A. R. Hughes, Bombay; The Honorary Secretary, Ranikhet Club, Ranikhet, U. P.; Mr. Wm. Harper, Bombay; Mr. Rustomjee D. Dalal, Bombay; Khan Bahadur D. B. Cooper, Satara; The Librarian, Lucknow Military Prison & Detention Barracks Library, Lucknow, U.P.; Raja Sardar Singh Bahadur, Khetri, Rajputana; Mr. Muhummud Faiyuz Khan, F.R.G.S., F.Z.S., Agra, U. P.; Mr. C. E. Atwood, Bombay; Mr. C. P. Gouldsbury, Mattupatti, S.I.; Mr. C. P. Wallace, Bombay; Mr. B. P. Patel, Bombay; Mr. K. C. Dinshaw, J.P., Bombay.

The first case of a series to illustrate the classification of Indian Birds was exhibited before the gathering.

Sir Reginald Spence read a paper on 'Game Preservation in India' compiled from an enormous amount of material received from members, Forest Officers, Sportsmen and others competent to write on the subject from all over the country.

The paper (since published in the Journal) dealt with the existing methods of preserving game from destruction and suggested ways and means which might be employed with advantage in future. Game animals should, on the whole, be looked upon as the living assets of the country and therefore their development, and preservation should be encouraged by every legitimate means. In the paper attention was drawn to the various parts of the country which were gradually but steadily being depleted of game and where more stringent methods of control were called for.

This of course cannot be entirely left to the forest officials, generally speaking are more concerned with increasing their forest produce revenue than preserving game which is often injurious to the forest plantations.

After the paper was over, the Chairman introduced Mr. J. E. Barton, of the G. I. P. Railway, who very kindly prefaced the film 'Sport in India' which was subsequently shown, with his experiences with the cameramen and the beasts depicted.

The film was kindly lent by the G. I. P. Railway Publicity Department and was made at Betul, on the G. I. P. line in the C. P. The object was to show the public of Bombay what possibilities there were in the way of Big Game shooting within a twenty-four hours' journey from the City.

The pictures were much appreciated and the Chairman moved a vote of thanks both to the Publicity Department of the G. I. P. Railway and to Mr. Barton for his prefatory remarks.

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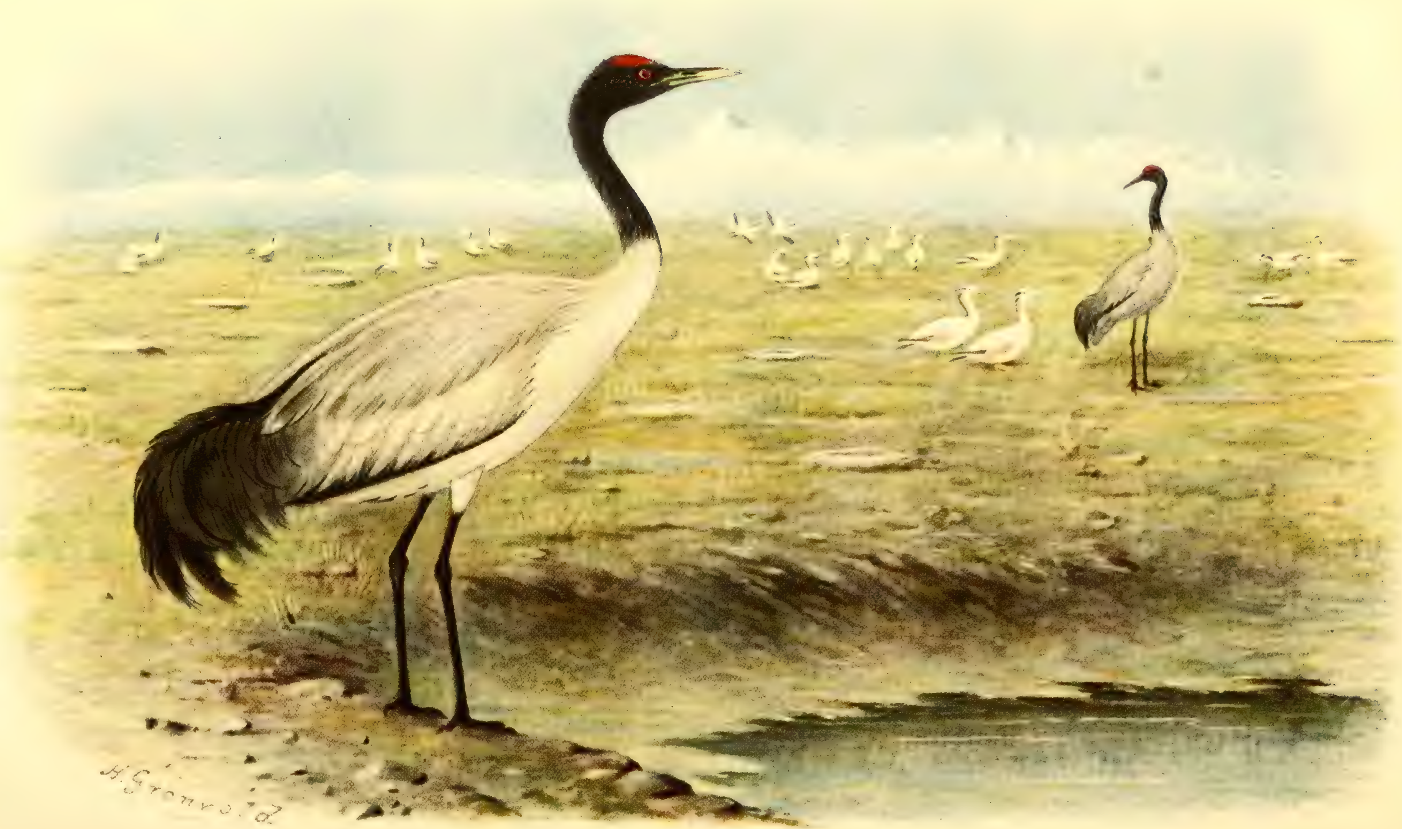

THE BLACK-NECKED CRANE
Megalornis nigricollis
1/11 Nat. size.

JOURNAL

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MAY, 1928 VOL. XXXII No. 4

THE GAME BIRDS OF THE INDIAN EMPIRE

BY

E. C. STUART BAKER, F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

VOL. V

THE WADERS AND OTHER SEMI-SPORTING BIRDS

PART VI

(*With a coloured plate*)

(*Continued from page 407 of this Volume*)

MEGALORNIS NIGRICOLLIS

The Black-necked Crane

Grus nigricollis Przewalski, Mongd. Tang., ii, p. 135 (1876), (Koko Nur.)

Vernacular names.—Tung-du, Trung-dung. (Tibet).

Description.—Lores and crown dull red bare skin, sparsely covered with coarse black hairs ; a patch of feathers below and behind the eye white, sometimes extending in a narrow line over the eye ; rest of head and neck black ; wing-quills dull black ; the innermost prolonged secondaries black ; inner webs of outer secondaries black or mottled with black and many of the greater coverts over the secondaries more or less black on the inner webs ; scapulars sometimes with a little black mottling on their terminal quarters ; remainder of plumage pale ashy-grey, the shafts of the feathers of the upper plumage showing as fine darker brown lines ; tail dark blackish-grey, tipped and edged paler grey.

Colours of soft parts.—" Iris yellow ; bill horny-grey or horny-green, more yellow towards the tip ; legs and feet black " (Ludlow.)

Measurements.—Wing 625 to 668 mm.; tail 234 to 947 mm.; tarsus 223 to 252 mm.; culmen 124 to 137 mm.

Distribution.—Ladak, Tibet, Setchuan and Yunnan, where it was procured by Forest, *Nidification.*—The Black-necked Cranes' nest and eggs were first discovered by Capt. R. Steen in 1905–6 at the Hramtso Lake in Tibet at an altitude of about 14,700 ft. Later Capt. J. Kennedy, Major F. M. Bailey and others found it breeding in some numbers about various Tibetan lakes and Osmaston also found it breeding in the Ladak Lakes.

The nest varies considerably. Often it is a mere scratching in the ground with a pretence of lining, just a few reeds and rushes forming a bed for the eggs to lie on. At other times a more pretentious nest is made and quite a pile of grass, rushes and other weeds is accumulated having a good depression in the centre for the eggs. The bird breeds on the same ground as the Bar-headed Goose and sometimes its own nest is surrounded by the large down-covered nests of these birds. The eggs are two in number and closely resemble those of the Common Crane except in being much bigger. Most of those I have seen are rather dingy olive-brown or olive-green eggs scantily blotched with dull reddish-brown or purplish-brown with secondary, or underlying, markings of purple grey or reddish-grey. Twelve eggs average 101·2 × 64·1 mm.; maxima **105·0** × 63·4 mm. and 103·2 × **69·1** mm.; minima **96·4** × 64·1 and 39·3 × **59·6** mm.

The breeding season is from the end of May to the first week in July, most eggs being laid between May 25 and June 15.

Habits.—Walton found this crane very wild and difficult to approach in the Gyantse plateau but much more tame round about Lhasa, though it seems equally common in either place. During the breeding season it is constantly found in company with Bar-headed Geese and looks very curious as it stalks about, its black head and neck towering above the very white geese. It keeps entirely to the shores and islands of the lakes and to the wide open plateaus, feeding both on vegetable shoots and on all kinds of insects, small reptiles, etc. Ludlow describes its call as very like that of the Common Crane and its flight is said to be powerful and graceful.

MEGALORNIS LEUCOGERANUS

The Great White or Siberian Crane

Grus leucogeranus Pallas, Reise Reich. Rus., ii, p. 714 (1773); (Irtin and Ob Rivers.); Blanf. and Oates, iii, p. 187.

Vernacular names.—Kare Khar. (N. W. P.), *Tunki* (Oudh), *Chini Kulang* (Hansi, Hind.); *Burmuch* (Behar).

Description.—Winglet, primary coverts and primaries black; forehead, fore-crown, face and sides of head bare except for a few white bristles; remaining plumage pure white.

Colours of soft parts.—Naked skin of head reddish; iris bright pale yellow; bill umber brown; legs and feet pale reddish-pink. (Hume).

Measurements.—Wing ♂ 635 to 645 mm.; ♀ 538 to 620 mm.; tail 205 to 218 mm.; tarsus 275 to 285 mm.; culmen 185 to 197 mm.

Young birds have the whole head clothed with white feathers and, according to Hume, have the white plumage tinged with buff.

Distribution.—South-eastern Europe, Asia Minor, through Siberia to Japan. In winter migrating to India and North China.

Nidification.—There is very little known of the breeding of this fine crane. It is said by Godlewski to be the most wary and shy of all cranes, inhabiting the steppes near the large rivers, arriving at its breeding haunts in April and leaving again in September. Dresser gives the following as known breeding places. Russia on the lower Ural and in the Perm Government (both uncommon); in the Tolol and Targai Governments, not uncommon; in the northern parts of Turkestan; Dauria on the Vilnui River; in the delta of the Kolzma; Amur, Ussuri to N. E. Mongolia. As regards its nest the only note I have is from Kuschel who in sending a pair of eggs, writes, "I have another pair, both taken by a Russian collector from nests of rushes and reeds on the ground by a lake." The two eggs sent me measure 98·9 × 54·6 and 95·0 × 62·0 m. In colour these have a rather bright reddish-olive ground, well blotched with dark brown primary and purple-grey secondary markings. They can be matched by many eggs of the Common Crane. An egg received by Dresser from Bianchi was paler than most eggs of that bird, but unusually heavily blotched, whilst another laid in Lord Lilford's grounds was a darker colour than most. These two eggs measured 92·7 × 61·7 and 101·3 × 63·2 mm. Other eggs laid in the aviaries of Mr. St. Quentin seem to closely resemble these. Finally, a pair of these eggs from Bianchi was also once exhibited by Dresser at a meeting of the B. O. C.[1] but not described or measured.

June seems to be the month when most eggs are laid, whilst two seems to be the normal clutch. As, however, with many other cranes, often only one young survives and Hume noted that the old birds on arrival in India usually had only *one* young one with them.

Habits.—The Siberian Crane arrives in North-west India about the middle of October, sometimes a little earlier, sometimes not until the third week of that month. Further south they appear still later, not reaching their extreme southern limits until the last week in October or even early November. It regularly visits most parts of North-west India and spreads in lessening numbers as far as the Najafgurh Swamp near Delhi on the south to Jainagar in Behar on the east (where it was seen by Inglis) and to Kohee, twenty miles south-east of Kamptee near Nagpur. Nowhere does it arrive in vast multitudes like the Common and Demoiselle Cranes but only in small flocks seldom numbering more than twenty individuals and often consisting of one or two pairs and their young ones.

This Crane is said to be the most elegant and graceful of all our cranes. Hume says of it, "It is the lily of birds and stand in what position it may, the entire outline of its form presents the most graceful and harmonious curves."

It is exceedingly wary and shy and the utmost patience and care are required for a successful stalk. Moreover the birds keep entirely, or almost so, to places where there are no facilities for stalking. They stand or wade all day long in shallow swamps or lakes well away from cover and if there are beds of tall reeds and rushes round the edge of these same pieces of water, be sure the birds will be nowhere near them. Hume, who tried all kinds of ways to get within shot says there is but one way of doing so. " You obtain from one of the local fowlers a trained buffalo, and enter the water a good quarter of a mile away from the bird, under cover of this quadruped. It has, as usual, a string run through the nostrils and tied lightly together behind the horns. You hold this string where it lies across the cheek with the left hand; your extended left arm is hidden behind the neck; your whole body is bent, so that your head and shoulders are covered by the buffalo's shoulders, your body and the greater part of your legs, by its body. Only your legs to a little above the knees show close to the hind legs; and, as far as possible, you always keep the beast up to his belly in water. Thus covered you slowly sidle up to the Cranes, making the buffalo, now put his nose up, head in air, now stop and lower his head to the water, and generally dawdle and meander about without apparently any fixed idea in his head, accordingly to the natural manner and customs of a free and independant buffalo. With a little practice it is easy thus to get within shot. You softly let the cheek strings go and at once fire below the buffalo's neck. Before your gun is well off, your sporting companion, who has a marked distrust of Europeans and white faces, and has been incessantly endeavouring to kick you throughout your whole promenade, knocks you head over heels, and rushes off towards his dusky owner, bellowing as if he, and not you, were the injured party."

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[1] *Bull. B. O. C.*, vol. xxi, p. 53.

When not killed outright it defends itself stoutly with legs, wings and bill,but chiefly with the latter, against either human or other foes.

They feed principally on aquatic plants and seldom resort to cultivated dry plains, at all events during their stay in India, nor have the remains of any animals or insects been found in their stomachs. Hume remarks on the remarkable number of small pebbles often found in the stomachs of these birds. Out of an old male he took enough to nearly fill a wine glass, the pebbles being mostly quartz or green stone ranging in size from a pin's head to an ordinary pea.

Their flight is similar to that of the ordinary crane and though they seldom soar, they do so occasionally with ease and grace. Apparently they have no trumpet call like most cranes and their cry has been likened to a repetition of the syllables *karekhur* rapidly repeated whilst their usual note when feeding and undisturbed is a feeble chirrup.

MEGALORNIS MONACHUS

The Hooded Crane

Grus monacha Temm., Pl. Col., pl. 555 (1835) (Yesso and Korea).

Vernacular names.—None recorded.

Description.—Lores, forehead and fore crown covered with black bristles; remainder of head and neck pure white; all the rest of the plumage dark slaty-grey, more or less tinged with brown, especially on the upper parts ; edges of the feathers both above and below fringed with grey, these almost disappearing in abraded plumage ; quills, the decomposed ends of the drooping secondaries and the tail blackish-brown.

Colours of soft parts.—" Iris yellow ; bill greenish tinged with red towards the base ; feet dull reddish " (Blyth).

Measurements.—Wing 510 to 545 mm. ; tail 155 to 180 mm. ; tarsus 208 to 220 mm. ; culmen 92 to 110 mm.

Young birds appear to be a much paler grey ; the head is well covered with bristly feathers, grey with black shafts on the crown, whiter on the forehead and black on the lores and in a patch on either side of the forehead.

Distribution.—Breeding in Japan and Eastern Siberia, migrating south to China in winter. The only quite certain record of this crane's occurrence in India is that of a young bird shot by me in North Cachar in December, 1899, but I saw several of these cranes on two occasions in the lower reaches of the Subansiri in N. Lakhimpur. Hume saw a small flock of cranes in Manipur which must have been this species and other probable occurrences are recorded by Anderson at Ponsee, west of Bhamo, and by Couchman near Myothil in Upper Burma.

Nidification.—I can find nothing on record beyond the statement that it undoubtedly breeds in Dauria, Amur and in Eastern Siberia and that it arrives in its breeding haunts in April and leaves again in August.

Habits.—This crane is said to haunt open plains and marshes but to be nowhere very numerous, whilst even when migrating it collects in small parties only. According to David and Oustalet it migrates in pairs or in flocks of half a dozen to a dozen. The flock I saw in Cachar numbered seven, and those I saw on the Subansiri were in two flocks of seven and eight respectively. In each of these instances the birds were on the move and though I shot one in Cachar I could get nowhere near those on the Subansiri, though I spent a whole day trying to get at one flock which kept moving down stream and settling every half mile or so. The other flock rose when first disturbed and went right away at once, flying very high in a line and loudly trumpeting at the start. The flock I saw in Cachar seemed very tired as if they had flown far. They pitched very headlong on the banks of the stream I was boating down and stood still as if exhausted. Even after I had shot and secured one, the remaining six kept pitching among the short reeds on the river side, though they would not allow me to get within a hundred yards. Their call seemed to me much like that of the Common Crane and their flight also very similar. They rose with perfect ease from the ground and at once rose to a considerable height.

David and Oustalet comment on the affection shown by a pair of these birds, the one for the other, and narrate how the male of one pair being shot, the female descended to the ground and attempted to assist him to rise.

(*To be continued.*)

REVISION OF
THE FLORA OF THE BOMBAY PRESIDENCY

BY

E. BLATTER, S.J., Ph.D., F.L.S.

PART VI

GRAMINEÆ

BY

E. BLATTER and C. McCANN

(*Continued from p. 435 of this Volume*)

38. HETEROPOGON, Pers. ; Stapf in Prain Fl. Trop. Afr. ix, 410.

Perennial or annual grasses, with simple or more often upwards branched culms ; branches few to many, mostly flowering and gathered into a spatheate panicle ; racemes conspicuously dorsiventral, the bases of the male (or neuter) spikelets subimbricate on the back of the raceme, their upper parts bending forward around the sides, forming a hollow in which the fertile spikelets are enclosed, with their awns exserted anticously and often intertwisted. Spikelets 2-nate, those of the lower (1 to many) pairs alike in sex and shape, male or neuter, of the upper pairs differing in sex and shape, one of each pair sessile, the other pedicelled on the many-jointed rhachis of solitary racemes, terminating the culms and their upper branches ; rhachis, tough or upwards tardily disarticulating and glabrous between the homogamous pairs, readily disarticulating above them ; homogamous pairs long-persistent, the spikelets of the heterogamous pairs falling separately, the pedicelled with the pedicel, the sessile with the adjacent joint and the adjacent pedicel or its base. Sessile spikelets subcylindric, awned ; callus long, pungent, densely bearded upwards. Involucral glumes equal, the lower coriaceous rarely chartaceous, more or less tightly involute, quite keelless, nerves obscure, often connected by few transverse nerves in the upper part ; upper with a deep longitudinal groove on each side, coriaceous, rarely chartaceous, between them, thinner towards the margins, membranous at the tips, 3-nerved. Lower floral glume hyaline, nerveless, upper stipitiform from a hyaline very slender base, cartilaginous upwards and passing into a usually stout geniculate awn. Pale small or absent. Lodicules large or more or less reduced, to very minute. Stamens 3, often rudimentary or absent. Stigmas exserted terminally or laterally. Grain more or less linear in outline, subterete, slightly dorsally compressed ; embryo somewhat exceeding the middle of the grain. Pedicelled spikelets male or neuter, dorsally flattened, usually slightly asymmetric, and often somewhat twisted, muticous, imbricate. Lower involucral glume herbaceous, many-nerved, winged upwards from one or both keels ; upper membranous, lanceolate-oblong, acute, 3-nerved. Floral glumes hyaline, 1-nerved, well developed or more or less reduced. Stamens 3 or 0.

Species about 6, in the tropical and subtropical regions of the whole world.

Cke. describes four species under *Andropogon*, viz. *A. polystachyos*, Roxb., *A. triticeus*, R. Br., *A. Ritchiei*, Hook. f., and *A. contortus*, Linn. We transfer these to *Heteropogon* and add *Heteropogon oliganthus*, Blatter & McCann.

A. Not more than 30 cm. high
  I. Upper involucral glume of pedicelled spikelet 1–3-nerved ... ... 1. *H. oliganthus.*
  II. Upper involucral glume of pedicelled spikelet 5-nerved ... ... 2. *H. polystachyos.*

B. More than 40 cm. high
  I. Lower involucral glume dorsally deeply grooved ... ... 3. *H. insignis.*
  II. Lower involucral glume not dorsally grooved
    1. Ligule of several narrow membranous segments ... ... 4. *H. Ritchiei.*
    2. Ligule truncate, ciliolate ... ... 5. *H. contortus.*

1. **Heteropogon oliganthus**, Blatter & McCann, *nov. comb.—Andropogon oliganthus*, Hochst. ex Steud. Syn. Gram. 368 ; Hook. f. in F.B.I. vii, 201.

Description : A dwarf annual. Stems 7-15 cm. high, tufted, slender, sometimes creeping below, geniculate. Leaves 5-7·5 cm. long, quite flat, subensiform, acuminate, softly hairy, margins thickened, cartilaginous, sheaths compressed ; ligule very short, membranous. Spikes usually very shortly exserted from the long, narrow, glabrous spathes ; peduncle curved, puberulous. Spikes 8-16 mm. long, with 3-6 pairs of glumes, lower spikelets neuter. Joints and pedicels about half as long as the sessile spikelet, long-ciliate. Sessile spikelet 5 mm. long, oblong ; callus short, obtuse. Lower involucral glume obtuse, chartaceous, dorsally villous toward the base, not dorsally channelled, shining, faintly nerved, with narrowly involute margins, ciliolate towards the truncate tip, callus bearded, upper involucral glume obtuse, apiculate. Lower floral glume very short, broadly oblong, ciliate, upper with a shining awn 3-4 cm. long, column of awn glabrous. Pale very small. Anthers 1 mm. long. Pedicelled spikelet, neuter, larger than the sessile, ovate-oblong. Lower involucral glume herbaceous, obovate-oblong, truncate, distinctly 9-13-nerved, subemarginate, keels scabrous, margins ciliolate, hardly incurved, upper shorter by $\frac{1}{5}$, membranous, oblong, obtuse, 1-3-nerved, ciliate. Pale of upper floral glume very small.

Hackel, l.c., is of opinion that this species is intermediate between *Dichanthium* and *Heteropogon*, but comes nearer the *Heteropogons*, because the sessile spikelets differ from the pedicelled ones in shape, nervation and the dorsal furrow.

Locality : *Deccan* : Kalsubai (Patwardhan !) ; Mahableshwar, open edge above the precipices looking from Dhobi's Waterfall path to Elphinstone Point, elevation 4,500 ft., rainfall 270 inches (Sedgwick & Bell 4608 !) ; Panchgani (Blatter & Hallberg B1221 !, McCann !).

Distribution : Nilgiris.

2. **Heteropogon polystachyos**, Blatter & McCann. *comb. nov.—Andropogon polystachyos*, Roxb. Fl. Ind. i (1832), 261 ; Steud. Syn. Gram. 367 ; Hook. f. in F.B.I. vii, 989 ; Dalz. and Gibs. 301 ; Cke. ii, 989.—*A. pumilus*, Roxb. Ic. ined. t. 2021 (ex Hook. f.).

Description : Cke. l.c.

Locality : *Deccan* : Khandala (Woodrow) ; Mahableshwar, western side of hill (Dalzell & Gibson). We have not seen this species.

Distribution : Peninsular India.

3. **Heteropogon insignis**, Thw. Enum. Pl. Zeyl. 437 ; Benth. Fl. Austral. vii. 517.—*Andropogon triticeus*, R. Br. Prodr. (1810), 201 ; Hack. Monogr. Androp, 588 ; Steud. Syn. Gram. 368 ; Hook. f. in F.B.I. vii, 200 ; Cke. ii, 989.—*A. ischynanthus et liananthus*, Steud. l.c. 367.

Description : Cke. l.c.

Locality : *Konkan* : Above Kenery Caves (McCann 9634 !).—*Deccan* : Around Vital Hills, Poona (Bhide 782 !) ; Chattarshinji Hill, Poona (Ezekiel !) ; Khandala, very common on open hillside composed of rock fragments (McCann 9425 !) ; Igatpuri (McCann 4338 !) ; Mawal, Poona District (Woodrow).—*S. M. Country* : Manoli (Talbot 3978 !).—*Kanara* : Anmod, bare hillsides, elevation 2,000 ft., rainfall 200 inches (Sedgwick 3324 !).

Distribution : India (Burma, C. Provinces, W. Peninsula), Ceylon, Malaya, Australia.

4. **Heteropogon Ritchiei**, Blatter & McCann, *comb. nov.-Andropogon Ritchiei*, Hook. f. in F.B.I. vii, 201 ; Cke. ii, 990.

Description : Cke. l. c.

Locality : *Deccan* : Katraj Ghat, eleven miles S.E. of Poona (Gammie 1037 !) ; hills near Poona (Woodrow).—*S. M. Country* : Belgaum (Ritchie *teste* Hook. f.).

Distribution : W. Peninsula, apparently endemic.

5. **Heteropogon contortus**, Roem. & Schult. Syst. Veg. ii, 836 ; Stapf in Prain ; Fl. Trop. Afr. ix, 411.—*Andropogon contortus*, Linn. Sp. Pl. (1753), 1045 ; Hack. Monogr. Androp. 585 (*excl. A. polystachyus*, Roxb.) ; Hook. f. in F.B.I. vii, 199 ; Cke. ii, 990. For other synonyms see Hook. f. and Stapf ll. cc.

Vern. Names :—Sunkhali, Nani Sunkhali (Dohad) ; Survalu (Charodi) ; Kursali (Poona) ; Kusal, Sukhli kursali, Ganjali hullu (Belgaum) (ex Burns). Known to Anglo-Indians as Spear grass.

Description : Cke. l. c.

Locality : *Gujarat* : Sevalia (Chibber !) ; road to Lasandra (Chibber !) ; Sungiri (Gammie 15586 !) ; Junagad Kathiawar (Blatter 3789 !). — *Khandesh* : Bhusawal (Gammie !) ; Toranmal (McCann 9640 !).—*Konkan* : Dahe forests (Ryan 717 !) ; Osarvira forest, Mokhada range (Ryan 190 !) ; Malabar hill (McCann 3620 !) ; Mulgaum (McCann 4245 !) ; Parsik, railway line (McCann 9655 !) ; above Kenery Caves (McCann 9662 !).—*Deccan* : Katraj Ghat, 11 miles S. E. of Poona (Shevade !) ; Trimbak (Chibber !) ; Khandala, very common all over the hills (McCann 9422 !) ; Bairawadi, Purandhar (McCann 5059 !) ; Rahuri (Nana A264 !) ; Chattarshinji Hill, Poona (Ezekiel !); Manmad, river bed (Blatter A269 !) ; Igatpuri (McCann 4328 !) ; Panchgani (Blatter & Hallberg B1246 !, B1296 !, B1308 !).—*S.M.Country* : Dharwar, elevation 2,400 ft., rainfall 34 inches (Sedgwick 1820 !) ; Castle Rock (Gammie 15686 !) ; Badami (Talbot 2925 !).—*Kanara* : Yellapore (Talbot 734 !).

Distribution : Mediterranean region and tropics and subtropics generally.

Uses : For an interesting account of this grass see W. Burns, L. B. Kulkarni and S. R. Godbole : A study of some Indian Grasses and Grasslands, in *Mem. Dept. Agr. India* xiv (1925), 28–44.

Varieties : Hackel (l.c.) distinguishes two varieties and, excluding *polystachyus*, 5 subvarieties. His first variety *genuinus* is characterized by the male spikelets being more or less covered on the back or at least above or towards the margins with white, patent tubercle-based bristles. This character together with the degree of ramification of the culms forms the foundation of four subvarieties : *typicus*, *Roxburghii*, *hispidissimus* and *secundus*.

The second variety *glaber* has the male spikelets glabrous. Both varieties are represented in India, and all the subvarieties except *secundus*.

To Hooker f. (l. c.) these varieties and subvarieties appear ' to be too inconstant for definition ', and, according to Stapf (l.c.) the inconstancy of those characters ' is so evident that it is not worth while to discriminate between the forms corresponding to them.' Haines, too, has abstained from distinguishing varieties and forms.

Burns and others in the paper quoted above (p. 40) wrote in 1925 : ' In our observations at Kalas and elsewhere we noticed variability within the species, and early came to the conclusion that there must be definite varieties of *Andropogon contortus*. We can say with confidence that there are at least two varieties, differing markedly in size, habit, longevity, and in morphological characters. One is small and annual, the other large and perennial.' Since then Patwardhan and Hedge have published a paper[1] in which they describe in detail the morphology, anatomy, physiology and ecology of the two varieties. As the authors themselves identify their perennial variety with Hackel's subvariety *typicus*, and their annual variety with Hackel's *hispidissimus*, we shall refer to them in the following under Hackel's names. The description is taken entirely from the paper just mentioned.

Key to the varieties.

1. Lower involucral glume of pedicelled spikelet sparsely hairy with long tubercle-based deciduous hairs on the back, in the upper part and towards the margins ; lower part glabrous ... (*a*) var *genuinus*, subv. *typicus*.

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[1] G. B. Patwardhan and G. R. Hedge, Two varieties of *Andropogon contortus*, Linn. In Journ. Ind. Bot. Soc., vi (1927) 213.

2. Lower involucral glume of pedicelled spikelet densely hairy with tubercle-based persistent hairs all over the back ; hairs in lower part shorter than in upper ... ... (*b*) var. *genuinus*, subv. *hispidissimus*.

(*a*) **var. genuinus, subv. typicus,** Patwardhan and Hedge l. c. ; Hack. in Monogr. Androp. 586 (*sub Androp.*).

Description : Perennial. Stems densely tufted, 45 cm. to 1·2 m., suberect or decumbent, about 3 mm. thick at the base and much flattened, glabrous, simple or subfastigiately branched from the nodes of the upper half ; internodes not much longer than the leaf-sheaths. Leaves crowded at the base ; sheaths smooth, compressed, keeled, shortly auricled at the mouth ; ligule short, truncate, ciliolate ; lamina 5–35 cm. long, acuminate or abruptly so, at first folded inward, afterwards flat, rigid, suberect, ciliolate or sparingly hairy on the upper surface, with tubercle-based hairs towards the base, rough to the touch on both surfaces. In semi-dry or dry specimens the leaves may be vinaceous to deep vinaceous in colour. Spike solitary, terminal, 2·5–7·5 cm. long excluding the awn, with closely imbricating pairs of sessile and pedicelled spikelets. Spikelets subsecund, pedicelled ones all male or neuter ; of the sessile spikelets the lower 2 to 8 male or neuter awnless, the upper awned, female ; the lower awnless spikelets persistent, the upper awned ones deciduous. Sessile spikelet : Lower involucral glume narrow, linear-oblong, truncate or rounded, brownish, many-nerved, hispid with short sparse hairs, margin incurved, tip membranous ; upper involucral glume linear, obtuse, coriaceous, dark brown, hispidulous, 3-nerved, margins incurved. Lower floral glume oblong, hyaline, thin, nerveless, short, truncate, paleate ; upper empty, reduced to an awn about 7·5 cm. long, column slightly hairy, callus long, pointed, with a tuft of reddish brown hairs. Ovary linear, stigmatic branches from 6–8 mm. long, with thick-set hairs, carmine in colour, fading towards the tips. Pedicelled spikelet : Lower involucral glume lanceolate, obliquely twisted, sparsely hairy with long, tubercle-based, deciduous hairs on the back in the upper part and towards the margins, lower part glabrous, margins unequally winged ; upper involucral glume oblong-lanceolate, acuminate, 5-nerved, ciliate towards the tip, margins hyaline. Lower floral glume oblong-hyaline, 1-nerved, ciliate, epaleate, containing stamens ; upper empty, obovate, lanceolate, hyaline, ciliate, nerveless. Stamens 3, filaments 3 mm. long ; anthers oblong-lanceolate, cordate at base, pale yellow when young, light purplish vinaceous ; pollen grains round, not sculptured, dull grey. The sessile male spikelets in the lower part are similar to the pedicelled spikelets above. Fruit 5–8 mm. long, thinly hispid, dark brown with 2 deep furrows on the ventral side, armed with a pointed callus below and a long lash-like awn above.

Locality : Tegur (ex Burns and others).

Distribution : Tropics and subtropics generally, N. W. Himalaya, Afghanistan (ex Hackel).

(*b*) **var. genuinus, subv. hispidissimus.** Patwardhan and Hedge l.c. ; Hack. in Monogr. Androp. 587 (*sub Androp.*).—*Andropogon hispidissimus*, Hochstett. in Schimper Pl. Abyss. un. it. no. 1219.—*A. besukiensis*, Steud. in Zoll. Syst. Verz. 59.

Description : Annual. Stems little tufted, 15–60 cm. high, erect or slightly decumbent below, slender and slightly compressed near the base, glabrous, simple or subfastigiately branched from the upper 2 or 3 nodes ; internodes much longer than the leaf-sheaths. Leaves little crowded at the base ; sheaths smooth, slightly keeled, shortly auricled at the mouth ; ligule short, truncate and ciliolate ; lamina 2·5–20 cm. by 2·5–5 mm. wide, linear, acuminate or abruptly so, ciliate or hairy on the upper surface up to nearly half its length from the base with tubercle-based hairs, rough to the touch on both surfaces, in semi-dry or dry specimens straw to very light purple in colour. Spike solitary, terminal, 1–5 cm. long excluding the awns, with closely imbricating pairs of sessile (lower) and pedicelled spikelets. Spikelets subsecund, pedicelled, all male or neuter ; of sessile the lower 2–5 male or neuter, awnless, upper 4–12 female, awned. Those which are male or neuter persistent, the upper 4–12 pairs which include both males and females deciduous. Sessile spikelet : Lower involucral glume narrow, linear-oblong, truncate or rounded, brownish, many-nerved, densely hairy with whitish long hairs, margins incurved, tips membranous ; upper involucral glume linear, obtuse, coriaceous, dark brown, hispidulous, 3-nerved with incurved margins. Lower floral glume oblong, hyaline, thin, nerveless, short, truncate, epaleate, upper empty, reduced to an awn, 5·1 cm. long, column densely hairy with whitish hairs, callus long, pointed, bearded with light brown hairs. Ovary linear, stigmatic branches 4-5 mm. long with thinly set ox-blood red hairs. Pedicelled spikelet : Lower involucral glume lanceolate, obliquely twisted, densely hairy with tubercle-based, persistent hairs all over the back, hairs on lower part shorter than in upper ; upper involucral glume oblong-lanceolate, acuminate, 5-nerved, ciliate, tip hairy, margins hyaline. Lower floral glume oblong, hyaline, 1-nerved, ciliate, upper oblong or obovate-lanceolate, hyaline, nerveless. Stamens 3, filaments 4 mm. long ; anthers oblong, sagitate, pale yellow when young, sulphur yellow when mature ; pollen grains round, smooth, dull grey. The sessile spikelets in the lower part are similar to the pedicelled spikelets above. Fruit 5-8 mm. long, densely hairy with whitish soft hairs, light brown with two deep furrows on the ventral side, armed with a pointed callus below and a long, lash-like awn above.

Locality : 'Usually found on the very shallow parts of Deccan soils' (ex Burns and others, l. c.).

Distribution : Malabar, tropical Africa, Madagascar, Java, Phillippines.

39. ISEILEMA, Hack. ; Cke. ii, 995.

Cke. has described two species : *I. Wightii*, Anders. and *I. laxum*, Hack. We add a third one, *I. anthephoroides*, Hack.

The following key is after Hole[1] :—

A. Lower involucral glume of hermaphrodite spikelet dorsally appressed, hairy at base and ciliate on margins in basal ¼ ... 1. *I. anthephoroides*.
B. Lower involucral glume of hermaphrodite spikelet glabrous dorsally at base and on margins in basal ¼.
  I. Spathe and upper floral leaf not tubercled on keel ... 2. *I. laxum*.
  II. Spathe and upper floral leaf tubercled on keel ... 3. *I. Wightii*.

1. **Iseilema anthephoroides**, Hack. Monogr. Androp. 683 ; Hook. f. in. F.B.I. vii, 219 ; Haines Bot. Bihar & Orissa, 1054.

Description : A much tufted annual grass, very leafy below, with many stems 30-80 cm. high, sometimes pink, nodes glabrous. Leaves mostly short, the longer ones about 13 cm. by 5 mm., subobtuse, ciliate at base and tip of sheaths, cilia with small tubercle-bases, blades with scabrid margins, nerves usually fine and uniform ; ligule of short fine hairs. Panicles long, rather strict, but some of the spatheoles divergent, lower spathes foliaceous, upper with shorter blades, base of blade and top of sheath with very long cilia ; spathes often with many tubercles on the margins. Spatheoles cymbiform, not acuminate, smooth and glabrous or minutely tubercled and scaberulous, margins scarious, several spatheoles from each spathe or leaf-sheath. Peduncle of cluster very short, 2·5-5 mm. long. Cluster scantily bearded at the base. Involucral spikelets broadly oblong, 4 mm. long, rounded at tip, not or very sparsely ciliate, their pedicels about 1 mm. long and nearly as broad at top, compressed, bearded. Glumes 2 only. Lower involucral glume with narrowly inflexed margins, strongly 2-nerved on the back and almost sulcate on either side of midrib, 2 other partial nerves between the strong ones, upper involucral glume nearly as long, flat, oblong, obtuse, 1-nerved ; floral glume absent. Anthers yellow. Sessile spikelet 5-6 mm. long, suddenly tapering part or beak rather longer than the lower broader part. Lower involucral glume 2-cuspidate at tip, 4-nerved between keels, hispid-hairy on the back on the wider portion, the beak scabrid or scabrellous ; upper involucral glume as long, narrowly lanceolate with prominent ciliate keel on lower third, scabrellous above, margin inflexed. Lower floral glume very narrow, 2-nerved, ciliate, upper reduced to the membranous base of the awn, awn 12–14 mm. long, very slender, nearly smooth.

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[1] R. S. Hole, The Indian Species of *Iseilema*, Agric. Journ. of India, Special Ind. Sc. Congress Number (1917), 125-131. See also A. Camus, Le genre *Iseilema*, in Bull. Soc. Bot. France, series 4, xxiii (1923), 493.

Locality: *Khandesh*: Near Naradana (Blatter & Hallberg 5206!) —*Deccan*: Katraj Ghat (Gammie 929!); Deolali (Blatter & Hallberg A316!); Chattarshinji Hill, Poona (Ezekiel!); Pashan (Gammie!).—*S. M. Country*: Black soil fields E. of Hubli (Sedgwick & Bell 5295!); Yelvigi (Sedgwick 2085!).

Distribution: W. India and Deccan.

Uses: A smaller yielder and an inferior fodder plant than *I. laxum*. See W. Burns Bull. 78, Dept. Agric. Bombay, p. 11.

2. **Iseilema laxum,** Hack. Monogr. Androp. 682; Hook. f. F.B.I. vii, 218; Cke. ii, 996. For synonyms see Hook. f. l. c

Description: Cke. l. c.

Locality: *Gujarat*: Red upland near Talod (Sedgwick!).—*Khandesh*: Bor, Bori River (Blatter & Hallberg 4429!); Toner, Tapti bank (Blatter & Hallberg 5167!); Dadgaum (McCann A322!).—*Konkan*: Sion (McCann 3668!); Thana (McCann 8728!); Parsik Hill (McCann A321!); Bhandup, rice field (McCann A323!); Trombay (McCann A324!).—*Deccan*: Grasslands between Mahableshwar and Panchgani (Sedgwick & Bell 4742!); Nasik (Bourke!); Lohagad, half way up (McCann A320!); Poona (Jacquemont 439).—*S. M. Country*: Dastikop (Sedgwick 2059!); Dharwar (Sedgwick 1826!); Belgaum (Ritchie 799).—*Kanara*: Halyal (Talbot 2087!); Sirsi (Kulkarni!).

Distribution: Upper Gangetic Plain, Orissa, Deccan, W. Peninsula.

Uses: Considered to be the best fodder grass in Central and S. India.

3. **Iseilema Wightii,** Anders. in Nov. Act. Soc. Sc. Upsala ser. 3, 2 (1858), 251; Hack. Monogr. Androp. 679; Hook. f. F. B. I. vii, 218; Cke. ii. 996. For synonyms see Hackel and Hook. f. ll. cc.

Vern. Names: Mabid (Dohad), Moshi (Surat), Gandhi (Charodi), Gandheli (Panch Mahals), Sona, Tambrut, Tambit, Gondval, Gamsi, Mussau (ex Burns).

Description: Cke. l.c.

Locality: *Gujarat*: Kharaghoda (Saxton 503C!); in a very marshy valley between Wastrapur and Thaltij (Sedgwick 322!); Morvi, Kathiawar (Woodrow).—*Khandesh*: Antroli, Bori River (Blatter & Hallberg 5150!).—*Deccan*: Panchgani (Blatter & Hallberg B1294!); Poona (Woodrow).—*S. M. Country*: Kunnur (Sedgwick & Bell 4922!); Rhanibennur (Bhide!); Haveri (Talbot 2254!); Dharwar (Nana A325!); Belgaum (Woodrow).—*Kanara*: Halyal (Talbot 2143!).

Distribution: Throughout India.

Uses: A fair fodder.

40. THEMEDA, Forsk.; Cke. ii. 992.

Species about 16, in the tropical and subtropical regions of the Old World, chiefly Indo-Malayan.

Cooke describes 4 species: *T. imberbis*, T. Cooke, *T. ciliata*, Hack., *T. cymbaria*, Hack., and *T. tremula*, Hack. Following the laws of priority we have to substitute for the first two: *T. triandra*, Forsk. and *T. quadrivalvis*, O. Kuntze.

I. Involucral spikelets truly verticillate
  1. Involucral spikelets glabrous or more or less irregularly beset with tubercle-based hairs ... ... 1. *T. triandra.*
  2. Involucral spikelets always with a row of stiff bristles along the flexures near the tips, the bristles arising from coarse pale tubercles ... ... 2. *T. quadrivalvis.*

II. Involucral spikelets in closely superposed pairs
  1. Inflorescence a decompound thyrsiform panicle. Lower involucral glume of bisexual spikelets not channelled ... 3. *T. cymbaria.*

2. Inflorescence a racemiform panicle. Lower involucral glume of bisexual spikelets deeply channelled ... ... 4. *T. tremula.*

1. **Themeda triandra**, Forsk. Fl. Aegypt. Arab. cxxiii *et* 178; Schweinf. in Bull. Herb. Boiss. ii, Append. ii, 16, 95; K. Schum. in Engl. Pfl. Ost.—Afr. A. 51; Rendle in Cat. Afr. Pl. Welw. ii, 161; Pilg. in Engl. Pflanzenw. Afr. ii, 151, fig. 114; Pilg. in Mildbr. Wiss. Ergebn. Deutsch. Zentr.—Afr. Exped. ii, 45; Eyles in Trans. Roy. Soc. S. Afr. v. 298; Stapf in Prain Fl. Trop. Afr. ix, 416, *partem tantum nostræ speciei amplectens.—Themeda Forskalii*, Hack. in Monogr. Androp. 659, *excl. syn. Anthistiria hispida*, Thunb. *quæ est Tristachya leucothrix*, Trin. *sec.* Stapf.; Duthie Fodd. Grass. N. Ind. 43; Durand & Schinz Consp. Fl. Afr. v. 731; K. Schum. l.c. A. 23, 56, 79; Engl. Hochgebirgsfl. Trop. Afr. 115; Batt. & Trab. Fl. Anal. Algér. et Tunis 355; Stapf in Kew Bull. (1907), 212; Pilg. in Engl. Pflanzenw. Afr. ii, 119.—*Anthistiria imberbis*, Retz. Obs. iii, 11: Desf. in Journ. de Phys. xl, 293, t. 1; Thunb. Fl. Cap. i, 402, ed. Schult., 107; Kunth Enum. i, 481; Steud. Syn. Pl. Glum. i, 401; Stapf in Dyer Fl. Cap. vii, 366; Wood Natal Pl. ii, t. 133; Burtt Davy in Transvaal Agric. Journ. iii, 287, t. 52; Hook. f. in F.B.I vii, 211; Trin. Fl. Ceyl. v, 248; Prain Beng. Pl. 1207.—*A. glauca*, Desf. Fl. Atlant. ii, 380, t. 254 *excl. syn.—Stipa paleacea*, Vahl; Coss. & Durieu Expl. Scient. Algér. ii, 52.—*A. Desfontainei*, Kunth Rev. Gram. i, 161.—*A. ciliata*, Retz. l.c. (*non* Linn. f.); Lamk. Ill. t. 841, f. 2; Cav. Ic. 5, t. 459; Nees in Linnaea vii, 284 *et* in Fl. Afr. Austr. 121; Anders. in Peters Reise Mossamb. Bot. 562; Oliv. in Trans. Linn. Soc., xxix, 176; Roxb. Fl. Ind., i, 247; Grah. Cat. Bomb. Pl. 239; Dalz. & Gibs. Bomb. Fl. 304; Thw. Enum. Pl. Zeyl. 366; Trim. Cat. Ceyl. Pl. 108, Benth. Fl. Austr. vii, 542.—*A. Forskahlii*, Kunth Rev. Gram. i, 162, Enum. Pl. 481.—*A. vulgaris*, Hack. in Engl. & Prantl. Natürl. Pflanzenfam. ii, pars 2, 29.—*A. punctata*, Hochst. ex A. Rich. Tent. Fl. Abyss. ii, 448.—*A. paleacea*, Ball. in Journ. Linn. Soc. Bot. xvi, 734.—*A. australis*, R. Br. Prodr. 200.—*A. cuspidata*, Anders. in Nov. Act. Upsal. 2 (1856), 229.—*A. cæspitosa*, Anders. l.c. 241.—*A. argentea*, Nees Fl. Afr. Austr. 124.—*A. depauperata*, Anders, l.c. 243.—*A. syriaca*, Boiss. Diagn. Pl. Or. ser. i, fasc. 13, 72.—*Themeda polygama*, Gmel. Syst. 149.—*Stipa arguens*, Thunb. Prodr. 20 (*non* Linn.).—*Calamina imberbis*, Roem. & Schult. Syst. ii, 810.—*Themeda imberbis*, T. Cooke in Cke. ii, 993.—*T. imberbis*, Haines in Bot. Bihar & Orissa, 1049.

Hooker f. who deals with this species under *Anthistiria*, Linn., says in a preliminary remark (F.B.I., vii, 211): 'The species of this genus are most difficult of discrimination, of which the best proof is the irreconcilable conclusions of two excellent botanists, both experts in the order of *Gramineæ*, Anderson (in Nov. Act. Upsal iii, ii (1856)) and Hackel (Monogr. Androp.).'

He then criticizes Hackel for having restored Forskahl's name of *Themeda* 'because of its having four years of priority, and of Linnaeus' description of *Anthistiria* being very inaccurate.' He admits the claim of priority, but as to the other reason he rightly adds that if inaccurate description has to be considered, a host of the genera of old authors would have to be invalidated. Hooker finally decides in favour of *Anthistiria* because this genus 'had for upwards of a century been adopted by all botanical writers.' This reason, however, does not hold good in view of the present rules of nomenclature. Hackel restored *Themeda* in 1889 and since then most systematists have followed his example. It was easy to settle this point, but the real difficulty comes in when we have to define and give a name to all the material gathered by Hackel (l. c. 659-664) under his *Themeda Forskalii*, and by Hooker f. under *Anthistiria imberbis*, Retz. (F.B.I. vii, 211).

A glance at Hackel's synonymy and localities shows that he has included all the forms of this highly variable grass which are found in the tropical, subtropical and sometimes in the temperate regions of the Old World. The same applies to Hooker's *A. imberbis*, except that he separated Hackel's var. *dubia laxa* and restored it to its former specific rank of *A. laxa*, Anders. But this is of minor importance in this connection. It does not change the fact that both Hackel and Hooker describe the same material and of the same area though under different names.

Hackel justifies the adoption of the specific name *Themeda Forskalii* in this way: '*Themeda triandra*, Forsk. Fl. Aeg.-arab. p. 178, *Anthist. Forskalii* Kunth Revis. Gram. 1, p. 162, generis typus, a Forskalio prope Bulgose in

Arabia felici lecta, probabiliter etiam varietas est Th. Forskalii meae ; sed descriptio rem dubiam relinquit, specimina authentica desiderantur. Nec hucusque ullam hujus generis speciem in Arabia felici lectam vidi, etsi probabile est, Th. Forskalii varietates in Syria Abyssiniaque crescentes etiam in Arabia inveniri. Itaque nomen specificum " triandra " tamquam dubium et rem indicans quae in hoc et plerisque Graminearum generibus nullius est momenti, seposui, " Forskalii " a Kunthio datum non minus quidem dubium, sed generis auctorem commemorans recepi.'

Hooker does not agree with Hackel, ' The earliest names of this plant are *Themeda triandra*, Forsk., and *Anthistiria imberbis*, Retz. Hackel has abandoned both, substituting first *Anthistiria vulgaris*, and then *Themeda Forskalii*, on the ground that *A. imberbis* was perhaps not Forskahl's *T. triandra* (why then call it *Forskalii* ?) of which no type specimen exists, and because *triandra* indicates a character of no individual value in grasses. In so doing he overlooked Gmelin's name of T. *polygama* (Syst. 149). Having regard to the wide range of *A. imberbis*, from Australia to Africa, its presence in Arabia might well be anticipated ; and that it is a native of that country is now proved by Schweinfurth's finding Hackel's var. *glauca* in that country. This makes the var. (which is local, and not Indian) the type of the species, and if Forskahl's name of *Themeda* is to be retained, necessitates a re-arrangement of the varieties. To me it appears most expedient to retain Retz.'s name which applies to the prevalent form over the area of distribution as the specific one. '

Hooker's reasons against Hackel's view are certainly valid, but his own *Anthistiria imberbis* does not rest on a firmer foundation. The fact that the var. is local and not Indian should not prevent us from making it the type of the species, and the other circumstance that a re-arrangement of the varieties will become necessary if the name *Themeda* is retained, can only be a reason of expediency.

So far we come to the conclusion that Hackel and Hooker deal with the same material, but that neither name is satisfactory.

We come now to the latest publication affecting our question. Stapf l.c. has adopted the name *Themeda triandra*, Forsk. (1775) instead of *T. Forskalii* (1889), ' as there is no doubt that the type of Forskal's species, which apparently has been lost, was one of the forms covered by the description given by Stapf ' (see Schweinfurth in Bull. Herb. Boiss. ii, App. II, 16).

But here Stapf creates a new difficulty. His description applies only to the ' African share of Hackel's *T. Forskalii* '. In order not to be open to misstatements we quote the whole passage in which Stapf explains his position : ' The species, as defined here, is, however, taken in a sense somewhat narrower than Hackel's ; this restriction requires a short explanation. Hackel in his monograph of the *Andropogoneæ* distinguishes eleven varieties and as many subvarieties or forms within his *T. Forskalii*, whilst other authors have at various times described more than a dozen species, all of which come within the compass. There can be no doubt as to the close affinity of these forms and the question of their status is mainly one of expediency. A careful examination of the large amount of material at Kew and the British Museum has led to the conclusion that for the present it will be most useful to detach, firstly, those forms that are fairly uniform, and at the same time exclusive, over a large area ; and secondly, those that, though of a limited range, stand out from the remainder by some character or characters. This leaves a residuum much less homogeneous than any of the segregates just referred to. It consists apparently of more or less fixed races, mutants, hybrids and edaphic forms which from herberium material are the less separable because they are to a high degree independent of geographical areas. At the same time, however, they are all African with an extension into Arabia, Syria and the south-eastern corner of Asia Minor, and, taken as a whole, represent practically the African share of Hackel's *T. Forskalii*. It is to this aggregate that the description and synonymy given above apply.'

From the above it is evident that Stapf's *T. triandra*, Forsk. is not identical with Hackel's *T. Forskalii* and Hooker's *A. imberbis*, Retz., as it comprises only the African element including ' an extension into Arabia, Syria, and the south-eastern corner of Asia Minor.' Stapf's synonymy leads to the same conclusion, except for the inclusion of *T. imberbis*, T. Cooke (Fl. Bombay ii, 993). The Australian element *Anthistiria australis*, R. Br. has been separated by the same author as *Themeda australis*, Stapf. It seems to us that Stapf's treatment of *T. Triandra* is somewhat arbitrary. We quite agree that the name should remain and that it is the only correct name, but we cannot agree to its being restricted to the African element only, and it is difficult to understand why the Indian specimen should not go by the same name. If we could distinguish groups of varieties or forms that are confined to more or less definable geographical areas, it would be admissible to speak, e.g. of an African group and call it *T. triandra*, because Arabia exhibits one of those African forms, or of an Indian or Australian group, and name them accordingly. But experience shows that with regard to the material under review there are no such geographical areas which contain a group of varieties or forms that are peculiar to one area exclusively. A glance at the localities given by Hackel under the different varieties and sub-varieties will confirm our statement.

We are, therefore, of opinion that the name *Themeda triandra*, Forsk. should embrace all the material that was described by Hackel under *T. Forskalii*, by Hooker under *A. imberbis*, and by Cooke under *T. imberbis*.

Haines describes the material from Bihar and Orissa under the name of *T. imberbis*, T. Cooke, and adds in brackets 'partly'. His species, therefore, is not Cooke's *T. imberbis*, but must be given some other specific name as long as Cooke's name stands. But if botanists adopt our *T. triandra*, Forsk. Haines' name will be merged in it, and his material may be treated as a form or group of forms under that species.

Description : See Hackel, Hook. f. and Cooke ll. cc.

Locality : *Gujarat* : Ahmedabad (Gammie 16391 !).—*Khandesh* : Toranmal (McCann 9813 !).—*Konkan* : Mokhada range (Ryan 2626 !) ; Mahaluxmi (Sabnis A297 !) ; Bhandup (McCann 9810 !) ; Bassein (McCann 4475 !).—*Deccan* : Ganeshkhind Botanic Gardens (Garade !) ; Panchgani (Blatter 3806 !, Blatter & Hallberg B1326 !) ; Khandala, common (McCann A291 !) ; Bairawadi, Purandhar (McCann 5069 !) ; Igatpuri (McCann 4322 !) ; Poondra (Talbot 4307 !).—*S. M. Country* : Devaranji, elevation 1,800 ft., rainfall 90 inches, (Sedgwick & Bell 4427 !) ; Castle Rock (Gammie 15728 !) ; Dudsagar Falls (McCann A298 !) ; Dharwar (Nana A289 !).

Distribution : Africa, Indo-Malaya, Australia.

2. **Themeda quadrivalvis**, O. Kuntze Rev. Gen. Pl. II, 794 ; Stapf in Prain Fl. Trop. Afr. ix, 420 ; Haines in Bot. Bihar & Orissa 1050.—*Andropogon quadrivalva, err. typog.*, Linn. Syst. ed. 13, 758.—*Themeda ciliata*, Hack. in Monogr. Androp. 664 ; Cke. ii, 994.—*Anthistiria ciliata*, Linn. f. Suppl. 113 ; Gærtn. Fruct. ii, 465. t. 175 ; Lam. Ill. t. 841, fig. 1 ; Beauv. Agrost. t. 23, f. 7 ; Kunth Enum. i, 481 ; Steud. Syn. Pl. Glum. i, 401 ; Baker Fl. Maurit. 448 ; Balf. f. Bot. Socotra 317 (*partim*) ; Duthie Grass. N. W. Ind. 42 ; Hook. f. in F B.I. vii, 213 ; Stapf in Dyer Fl. Cap. vii, 368.—*A. scandens*, Roxb. Fl. Ind. i, 248 ; Duthie Fodd. Gr. N. W. Ind. t. 61.—*A. semiberbis*, Nees. Fl. Afr. Austr. 125.—*Andropogon nutans*, Linn. Mant. ii, 303.

Vern. Names : Bongrut (Sholapur) ; Bhathu (Surat) ; Bhati, Zini bathi, Mothi bathi (Dohad) ; Bhatharu (Broach) (ex Burns).

Description : Cke. l.c.

Locality : Gujarat : Ahmedabad (Gammie 16391 !).—*Khandesh* : Toranmal (McCann 9817 !).—*Konkan* : Parsik, railway line (McCann 9808 !) ; Alibag, water-works (Ezekiel !) ; S. Konkan (Stocks *teste* Cooke, Law) ; Salsette (Jacquemont 717 *teste* Cooke).—*Deccan* : Pashan, near Poona (Gammie !) ; road, Mahableshwar to Pratapgad (Bhide 1170 !) ; Purandhar (McCann 5571 !) ; Bairwadi, Purandhar (McCann 507A !) ; Panchgani (Blatter & Hallberg B1311 !, B1325 !).—*S. M. Country* : Konankeri, elevation 2,000 ft., rainfall 40 inches (Sedgwick & Bell 4943 !) ; Dharwar elevation 2,400 ft., rainfall 34 inches (Sedgwick & Bell 4486 !) ; Dastikop elevation 2,500 ft., rainfall 35 inches (Sedgwick & Bell 2060 !) ; Castle Rock (Gammie 15729 !) ; Belgaum (Ritchie 886 *teste* Cooke).—*Kanara* : Halyal (Talbot 2115 !).

Distribution : N. W. India, Bengal, C. Provinces, W. Peninsula, Tenasserim. Introduced in tropical and S. Africa.

3. **Themeda cymbaria**, Hack. in Monogr. Androp. 668 ; Cke. ii, 994.—*Anthistiria cymbaria*, Roxb. Hort. Beng. (1814), 6, *et* Fl. Ind. i, 251 (*excl. syn.*) ; Kunth Enum. Pl. i, 482 (excl. syn.) ; Grah. Cat. Bomb. Pl. 219 ; Dalz & Gibs. Bomb. Fl. 304 ; Hook. f. in F. B. I. vii, 215 ; Trim. Fl. Ceyl. v, 249.

Description : Cke. l. c.

Locality: *Khandesh*: Dadgaum (McCann 9815 !); Toranmal (McCann 9818 !).—*Konkan*: common (Cooke); I am doubtful (McCann).—*Deccan*: Lonavla (Garade !).—*S. M. Country*: Castle Rock (Gammie 15634 !).—*Kanara*: Mirjan (Hallberg & McCann A295 !).
Distribution: W. Peninsula, Ceylon.

4. **Themeda tremula,** Hack. Monogr. Androp. 667; Cke. ii, 995.—*Anthistiria tremula,* Nees ex Steud. Syn. Gram. 401; Hook. f. in F.B.I. vii, 214.—*Androscepia tremula,* Anders. in Nov. Act. Upsal. ser. iii, ii (1856), 247.
Description: Cke. l. c.
Locality: *Konkan*: Trombay (McCann A293 !); Ghatkoper, Horse-shoe Valley (McCann A327 !).—*Deccan*: Khandala (McCann 5359 !); Igatpuri (Blatter & Hallberg 5484 !); Purandhar, northern foot (McCann 5041 !); Poona (Woodrow *teste* Cooke).—*S. M. Country*: Devaranji, elevation 1,800 ft., rainfall 90 inches (Sedgwick & Bell 4428 !); Castle Rock (Gammie 15687 !).—*Kanara*: Devimani Ghat (Kulkarni !); Jugglepet (Talbot 1568 !); Tinai Ghat (Sedgwick & Bell 3196 !); Sirsi to Siddhapur (Hallberg & McCann A294!).
Distribution: From the Central Provinces and the Konkan southwards, Ceylon.

41. PSEUDANTHISTIRIA, Hook. f.; Cke. ii, 992.

Species 4.—Indian.

Cooke has described one species: *P. hispida,* Hook. f. We add two others: *P. umbellata,* Hook. f. and *P. heteroclita,* Hook. f.

I. Ligule exauriculate
  1. Ligule a truncate glabrous membrane, much divided to the base, the tips minutely ciliolate. Sessile spikelets glabrous ... ... 1. *P. hispida.*
  2. Ligule short, membranous. Sessile spikelets not glabrous ... ... 2. *P. heteroclita.*
II. Ligule auricled ... ... 3. *P. umbellata.*

1. **Pseudanthistiria hispida,** Hook. f. in F. B. I. vii, 219; Cke. ii, 992.
Description: Cke. l.c.
Locality: *Gujarat*: Surat (Garade !).—*Konkan*: Dahe Forest (Ryan 705 !); Matheran (D'Almeida A329 !); Ghatkoper, Horse-shoe Valley (McCann A326 !); Sion (McCann 5247 !); St. Xavier's College compound, Bombay (McCann 4524 !); Kalyan (Woodrow).—*Deccan*: Lonavla (Gammie !); Purandhar Fort (Gammie 1010 !); Igatpuri Ghats (McCann 4343 !); Khandala, common, railway line (McCann A331 !); Panchgani (Woodrow).—*S. M. Country*: Castle Rock (Gammie 15634, McCann A328 !); Derikop (Sedgwick 2061 !); Londa (Gammie 15863 !, Woodrow).—*Kanara*: Birchy (Talbot 2096 !); Yellapore (Talbot 1522 !); Devimani Ghat (Kulkarni !).
Distribution: C. Provinces, W. Peninsula.

2. **Pseudanthistiria heteroclita,** Hook. f. in F. B. I. vii, 219.—*Andropogon heteroclitus,* Nees Fl. Afr. Austr. 115; Steud. Syn. Gram. 389; Hack. in Monogr. Androp. 400.—*A. monomeros,* Hochst. in Hohen. Pl. Ind. Or. no. 183.—*Anthistiria heteroclita,* Roxb. Fl. Ind. i, 249.
Description: Stems 30–80 cm. high, geniculate, slender, terete, smooth, subsimple or branched. Leaves linear, 15–30 cm. long, 3–5 mm. broad, glabrous or more or less ciliate on both surfaces, nerves distinct, margins with long, tubercle-based hairs or nearly glabrous; sheaths much shorter than the internodes, quite glabrous; ligule short, membranous, exauriculate. Panicles 20–30 cm. long, leafy, compound, with many shortly peduncled fascicles, fascicles of spikes about 12 mm. broad, proper spathes 7–10 mm. long, hardly longer than the spikes, towards the margin with long, tubercle-based bristles; spikes 6–8 mm. long. Sessile spikelets 3–4 mm. long, linear-oblong, hispidulous all over. Lower involucral glume furrowed. Upper floral glume awned, awn 18–24 mm. long, thin. Pedicelled spikelets lanceolate, with a few long, tubercle-based bristles, keel ciliate.
Locality: Konkan (Law ex Hook. f.).
Distribution: Bengal, Konkan, S. Kanara.

3. **Pseudanthistiria umbellata,** Hook. f. in F. B. I. vii, 220.—*Andropogon umbellatus,* Hack. Monogr. Androp. 401.

Description : A very slender, glabrous plant with filiform, prostrate, creeping branched stems, rooting at the nodes, stems 30-60 cm. long, compressed. Blade 2–5 cm. long, distant, linear-oblong, acute, rounded at base, sessile or short-petioled, nerves distinct, very slender, with a few scattered cilia on both surfaces, nearly smooth ; sheaths shorter than the blade, often with tubercle-based hairs above, rarely glabrous ; ligule passing at the sides into 2 short, herbaceous, fimbriate auricles of the sheath. Panicle leafy, very lax, interrupted, 12-20 cm. long ; fascicles of spikelets few, axillary, 6-12 mm. broad, glabrous or with a few tubercle-based cilia on simple, rarely branched capillary peduncles shorter than the leaves ; lower peduncles sometimes elongate, 2·5–7·5 cm. long and bearing several fascicles ; outer spathes 8-25 mm. long ; spikes 3-6 in a fascicle, proper spathe 10–12 mm. long, rather longer than the spikes, glabrous or towards the margin with a few bulbous-based hairs. Sessile spikelets 3-4·5 mm. long, linear, scaberulous. Lower involucral glume dorsally concave ; awn of upper floral glume 12–14 mm. long, very thin. Pedicelled spikelets linear-lanceolate, naked, awn 12–18 mm. long.

Locality : *S. M. Country* : Londa (Gammie 15869 !).—*Kanara* : Birchy (Talbot 2073 !).

Distribution : Deccan and W. Peninsula, Ceylon.

42. DIGITARIA, Hall. Hist. Stirp. ii (1768), 244 ; Stapf in Prain Fl. Trop. Afr. ix, 422.

Species more than 100, in the warm parts of the whole world, but chiefly in the Old World.

Cke. (ii, 940–942) describes 6 species. All are retained in this place, but the name of *Digitaria sanguinalis* will be replaced by *D. marginata*.

Key as in Cke.

1. **Digitaria ternata**, Stapf in Dyer Fl. Cap. vii, 376, *et* in Prain Fl. Trop. Afr. ix, 452 ; Cke. ii, 940.—*Paspalum ternatum*, Hook. f. in F. B. I. vii, 17.—*Panicum ternatum*, Hochst. in Flora xxiv (1841), 1, Intell. 19 ; Hack. in Oest. Bot. Zeitschr. (1901), 331.—*P. phænocarpum*, var. *gracile*, Nees Fl. Afr. Austr. 23.—*Cynodon ternatum*, A. Rich. Tent. Fl. Abyss. ii, 405.

Description : Cke. l. c. Occasionally long fine hairs are found on the peduncles.

Locality : *Deccan* : Purandhar Fort (Bhide !).—*S. M. Country* : Belgaum (Herb. Bot. Gard. Cal.).

Distribution : India (Khasia Hills, Burma, W. Peninsula), Yunnan, tropical and S. Africa.

2. **Digitaria marginata,** Link Hort. Berol. i, 229 ; Stapf in Prain Fl. Trop. Afr. ix, 439.

Description : Annual, 30 cm. to 1 m. high. Stems tufted, usually ascending from a geniculate or prostrate base, simple or branched from the lower nodes, glabrous, few to many-noded. Leaves 5–15 cm. by 4–8 mm., linear or linear-lanceolate from a slightly contracted and rounded base, acute, flat, flaccid, glabrous or sparingly hairy particularly towards the mouth, margins finely cartilaginous, rough and often crisp, midrib very slender, whitish ; sheaths thin, subherbaceous, loose, glabrous, or more or less beset with spreading tubercle-based hairs often forming a loose beard at the base ; ligules truncate, membranous, up to over 1 mm. long. Spikes mostly 4–9, sessile, subdigitate, solitary or 2–3—nate on a short, scaberulous common axis, erect or spreading, rather slender, strict or slightly flexuous 5–15 cm long, often finely pubescent at the base ; rhachis almost straight, triquetrous, lateral angles winged, herbaceous, scabrid, internodes up to more than 2 mm. long. Pedicels 2-nate, one very short, the other up to 1·5 mm. long, angular, scabrid. Spikelets appressed, lanceolate, acutely acuminate, 2–4 mm. long, pale greenish, rarely tinged with purple, variously hairy, rarely quite glabrous. Lower involucral glume an ovate, obtuse to subacute membranous scale, usually not over 0·3 mm. long, sometimes obsolete or quite suppressed ; upper ovate-lanceolate, acute, equalling or considerably exceeding half of the upper floral glume, rarely distinctly shorter, 3-nerved, with fine lines of hairs between the nerves and along the margins, rarely quite glabrous. Lower floral glume corresponding in outline and size to the spikelet, firmly membranous, 7-nerved, rarely quite glabrous, usually with fine lines of hairs between the inner side-nerves (of each half) and along the margins; upper floral glume oblong-lanceolate, acutely acuminate, almost as long as the spikelet, thinly chartaceous, pale or slightly purplish, brownish when ripe. Grain oblong, plano-convex, whitish, scutellum less than half the length of the grain.

This species is not identical with *Paspalum sanguinale*, Lamk. of the F. B. I. or with *Digitaria sanguinalis*, Scop., in Cooke's Flora or in Haines' Bot. of Bihar & Orissa. *D. sanguinalis*, Scop. (*sensu stricio*) is a plant of S. Europe and has not been found either in India or tropical Africa, as was pointed out by Pilger (in Engl. Jahrb. xxx, 118) and Stapf. Most of the numerous synonyms given by Hook. f. in the F. B. I. would have to be mentioned under the different varieties. Here we have to deal only with one variety which was described by Cooke as var. *ciliaris*, Prain and which was called var. *fimbriata* by Stapf.

var. fimbriata, Stapf, l. c. 440.—*Digitaria fimbriata*, Link Hort. Berol. l. c. 226.—*D. commutata*, Schult, Mant. ii, 262.—*D. chrysoblephora*, Fig. & De Not. in Mem. Acc. Tor. ser ii, xiv, 364.—*Digitaria ciliaris*, var. *quadristachya*, Wight.—*D. sanguinalis*, var. *ciliaris*, Rendle in Cat. Afr. Pl. Welw. ii, 163, and in Journ. Linn. Soc. Bot. xl, 228.—*Digitoria sanguinalis*, var. *ciliaris*, Prain Beng. Pl. 1181; Cke. ii, 940—*Panicum ciliare*, Retz. Obs. iv, 16; Kunth Enum. i, 82; Roxb. Fl. Ind. i, 290; A. Rich. Tent. Fl. Abyss. ii, 360; Dalz. & Gibs. Fl. Bomb. 290; Duthie Indig. Fodd. Grass. t. 9.—*P. fimbriatum*, Presl Rel. Haenk. i, 298; Kunth Enum. i, 81.—*P. sanguinale* var. *ciliare*, Franch. Contr. Fl. Congo Franc. 46.—*P. sanguinale* var. *blepharanthum*, Hack. in Durand & Schintz Consp. Fl. Afr. v, 762.—*P sanguinale*, var. *macrostachyum*, Hack. l. c. 763.—*Paspalum sanguinale* var, *ciliare*, Hook. f. in F. B. I. vii, 15.

Description: Upper involucral glume usually much exceeding the middle of the fertile floret and frequently equalling $\frac{4}{5}$ of its length. Indumentum of spikelets uniform or more often more or less varied in the same inflorescence; hairs of the upper involucral glume and lower floret partly in fine lines, all of one kind, very fine, thin-walled, obtuse-tipped, partly more thick-walled with slightly clavate tips, and up to 1 mm. long, spreading out at maturity and forming a rigid double fringe on each side of the spikelet, the inner fringe often mixed with a varying number of tubercle-based acute yellow bristles which ultimately also spread out at right angles.

It is well to remember what Stapf says in a note, l. c. 441: 'The peculiar indumentum of the spikelets, which in the mature state leads to the formation of spreading fringes, may extend to all spikelets alike or it may be, at least in its perfect development, confined to the long-pedicelled member of each pair of spikelets or only to some of them, in which case the indumentum of the fringeless spikelets approaches more or less that of var. *Linkii*.' Var. *Linkii*, Stapf is Hooker f's var. *commutatum* of *Paspalum sanguinale* in F. B. I. vii, 15.

Vern. Names: Tara (Surat); Shikaol or Arotaro (Dohad); Chansarieu (Broach); Taro, Modhan (Sind); Fakri, Fakria, Kurad, Suka, Revga, Dinohi, Shikar koli, Kalam hullu (Bijapur); Shimpigyan hullu (Belgaum) (ex Burns).

Locality: *Sind*: Sanghar (Sabnis B903!); Mirpurkhas, in cultivated fields (Sabnis B1209!); Bughar, Indus River (Blatter & McCann D686!); Ghulamalla, garden (Blatter & McCann D687!).—*Gujarat*: Cutch (Blatter 8742!); Ahmedabad (Herb. Econ. Bot. Poona!).—*Khandesh*: N. slope of Chanseli (McCann 9535!); Bor, Tapti Island, on sand and mud (Blatter & Hallberg 5463!); Muravat, Tapti Bank (Blatter & Hallberg 3839!); Umalla (Blatter & Hallberg 5178!); Amalner (Blatter & Hallberg 4443!); Sumit (Blatter & Hallberg 5188!); Bor, Bori River (Blatter & Hallberg 5213!); Dadgaum (McCann 9531!).—*Konkan*: Victoria Gardens, Bombay (McCann 9831!); Versova, Salsette (McCann 4308!); Malabar Hill (McCann 4300!); very common through the Islands of Bombay and Salsette (McCann!); Parsik, railway line (McCann 9530!); Bassein (McCann 4485!); Alibag, sandy shore (Ezekiel!).—*Deccan*: Khandala (McCann 3650!); Igatpuri (McCann 9833!); Purandhar (McCann 5606!); Chattarshinji (Ezekiel!); Pashan (Gammie!); Deolali (Blatter & Hallberg 4556!); Gangapur (Blatter & Hallberg 4581!); Panchgani, Maratha Well (Blatter & Hallberg B1233!).—*S. M. Country*: Haveri, dry ground, compound of P. W. D. (Talbot 2228!); Dharwar (Sedgwick !) ; Belgaum (Herb. Bot. Gard. Cal. !).—*Kanara* : Karwar (Talbot 1294 !) ; Haiyal (Talbot 2153 !) ; Kulgi (Talbot 2279 !).

Distribution : Tropics of both hemispheres, rarely found beyond the tropics.

3. **Digitaria pennata**, Chiov. in Result. Scient. Miss. Stefanini—Paoli i, 183 ; Cke. ii, 941, *erronee ascribens nomen Hookero f.* ; Stapf in Prain Fl. Trop. Afr. ix, 472.—*Panicum pennatum*, Hochst. in Flora xxxviii (1855), 197 ; Schweinf. in Bull. Herb. Boiss. ii, App. ii, 18.—*Paspalum pennatum*, Hook. f. in F.B.I. vii, 16.

Description : Cke. l. c.

Locality : *Sind* : Karachi (Stocks *teste* Hook. f.) ; Jemadar ka Landa, near Karachi (Stocks) ; Tatta, Kullan Kote (Blatter & McCann D684 !) ; Tatta (Blatter & McCann D685 !).—*Gujarat* : Porbandar (Bhide !) ; Morvi, Kathiawar (Woodrow).

Distribution : Baluchistan, tropical Arabia and Africa.

4. **Digitaria pedicellaris**, Prain Beng. Pl. (1903), 1181 ; Cke. ii, 941 ; Haines in Bot. Bihar & Orissa 1009.—*Paspalam pedicellare*, Trin. ex Steud. Nom. ed. 2 (1841), 272 ; Hook. f. in F.B.I., vii, 19.—*P. pedicellatum*, Nees & Arn. in Wight Cat. 2310 ; Duthie Grass. N. W. Ind. I.—*Milium sanguinale*, Roxb. Fl. Ind. i, 315 (*excl. syn.* Burm.).

Description : Cke. l. c.

Locality : *Konkan* : Thana (McCann 8725 !) ; Sion (Herb. S. X. C. !) ; Mulgaum (McCann 3663 !).—*Deccan* : Chattarshinji Hill, Poona (Ezekiel !).—*S. M. Country* : Hubli, elevation 2,000 ft., rainfall 30 inches (Sedgwick & Bell 4229 !).

Distribution : Throughout India.

5. **Digitaria longiflora**, Pers. Syn. i (1805), 85 (*non* Trin.) ; Cke. ii, 941 ; Stapf in Prain Fl. Trop. Afr. ix, 469 ; Haines in Bot. Bihar & Orissa 1008.—*Digitaria Pseudo-Durva*, Schlechtend. in Linnæa, xxvi, 458.—*D. linearis*, Schult. f. Mant. ii, 261 (*non* Roem. and Schult.).—*D. tenuiflora*, Stapf in Dyer Fl. Cap. vii, 380 (*non* P. Beauv.).—*Paspalum longiflorum*, Retz. Obs. iv, 15 (*non* Trin.) ; Baker Fl. Maurit. 431 ; Hook. f. in F.B.I. vii, 17 (*partim*).—*P. brevifolium*, Fluegge Gram. Monogr. 150.—*P. Pseudo-Durva*, Nees Fl. Afr. Austr. 21.—*P. filiculme*. Nees ex Thw. Enum. Pl. Zeyl. 358.—*Panicum longiflorum*, Gmel. Syst. 158.—*P. parvulum*, Trin. Pan. Gen. 117.—*P. argyrotrichum*, Durand & Schintz Consp. Fl. Afr. v, 741 (*non* Anders.).—*Milium filiforme*, Roxb. Fl. Ind. i, 314.

Digitaria tenuiflora, P. Beauv. given as a synonym by Cke. seems to be a different species. It is apparently a perennial of erect habit and with long narrow leaves.

Description : Cke. l. c.

Locality : *Deccan* : Deolali (Blatter & Hallberg 9835 !).—*S. M. Country* : Dry uplands, Dharwar, elevation 2,400 ft., rainfall 34 inches (Sedgwick 2653 !) ; Belgaum (Herb. Bot. Gard. Cal.).—*Kanara* : Halyal (Talbot 2310 !) ; Londa (Bhide !).

Distribution : Throughout India, Ceylon, tropical and S. Africa, Madagascar, Mascarenes, Malaya.

6. **Digitaria Royleana**, Prain Beng. Pl. (1903), 1181 ; Cke. ii, 942 ; Haines in Bot. Bihar & Orissa 1008.—*Paspalum Royleanum*, Nees ex Thw. Enum. (1864), 358 ; Hook. f. in F.B.I. vii, 18 ; Trin. Fl. Ceyl. v, 125.

Description : Cke. l. c.

Locality : *Konkan* : St. Xavier's College compound (McCann 4533 !) ; Mulgaum, Salsette (McCann 9523 !).—*Deccan* : Khandala (McCann 3651 !) ; Lonavla (Herb. Econ. Bot. Poona !) ; Purandhar Fort (Bhide !) ; Lina Hill, Nasik District (Blatter & Hallberg 4542 !); Lohagad, way up (McCann 9512 !); Katraj Ghat, 11 miles S.E. of Poona (Bhide !) ; Panchgani, slopes below Third Tableland (Blatter & Hallberg B1229 !) ; Panchgani, Maratha Well (Blatter & Hallberg B1224 !, B1281 !) ; Mahableshwar, in a garden, elevation 4,500 ft., rainfall 270 inches (Sedgwick & Bell 4584 !) ; Suvasni Ghat (Woodrow).—*S. M. Country* : Dharwar, elevation 1,600 ft., rainfall 34 inches (Sedgwick 2843 !) ; Belgaum (Herb. Bot. Gard. Cal. !).—*Kanara* : (Talbot!)

Distribution : Hilly districts throughout India, Ceylon ; apparently not in tropical Africa.

43. ALLOTEROPSIS, Presl, emend. Hitchc. in Contrib. U. S. Nat. Herb. xii, 210; Stapf in Prain Fl. Trop. Afr. ix. 482. (*Axonopus*, Beauv.; Cke. ii, 925).

Stapf (l. c. 483) explains why he adopts *Alloteropsis*, Presl, as emended by Hitchcock. 'As Hitchcock (Contrib. U. S. Nat. Herb. xii, 210) has pointed out, Presl's description and analyses of *Alloteropsis* are based on a composition of a Panicoid and an Andropogonoid grass, whilst the original in Presl's herbarium is undoubtedly the plant described here as *A. semialata*, and so is also the habit figure (1) in Presl's plate. The genus is therefore accepted here with Hitchcock's emendation.'

'Another member of this genus, *A. cimicina*, was included by Palisot de Beauvois (Agrost. 12) in his genus *Axonopus* under its earliest synonym *Milium cimicinum* and as "*A cimicinus*?" on p. 154, and this led J. D. Hooker (Fl. Brit. Ind. vii, 64) to use the name *Axonopus* in preference to *Alloteropsis*, a view which was adopted by myself in Fl. Cap. vii, 418. From P. Beauvois' diagnosis however, and from the fact that he quotes in the first place *Milium compressum* as example for *Axonopus*, there can be no doubt that he had primarily *Milium compressum* in view when establishing his genus *Axonopus*, and it is in that sense that the genus is understood in this work. *A. cimicina* also forms the basis of another genus, *Coridochloa*, Nees in Edinb. New Phil. Journ. xv, 381. A. Chase (in Proc. Biol. Soc. Washington, xxiv, 157) maintains this genus as distinct from *Alloteropsis*, and I followed her when drawing up the key of the genera of Tropical African grasses (p. 13); but I have since come to the conclusion that the species referable to these two groups are so similar in the peculiar structure of their spikelets that they are better merged into one genus for which *Alloteropsis* has priority over *Cordiochloa*.'

We have, therefore, to add the characteristics of the genus as given by Stapf:

Perennial or annual. Leaf-blades flat or more or less convolute; ligules membranous, ciliate or ciliolate, short or reduced to a mere rim. Racemes sessile or peduncled, often more or less compound towards the base, digitate or subdigitate on a more or less elongated common axis. Spikelets ovate or elliptic to lanceolate-oblong; acute or acuminate, mostly awned, slightly or conspicuously compressed from the back, falling entire from the pedicels, 2-nate or fascicled, subsecund and abaxial on the triquetrous rhachis of more or less spiciform racemes. Lower floret usually male, upper hermaphrodite. Involucral glumes unequal, lower smaller, membranous to hyaline, 3-1-nerved, very acute, often mucronulate, upper equal or subequal to the spikelet, membranous to chartaceous, 5-nerved, with the outer nerves submarginal, densely ciliate along them. Lower floral glume resembling the upper involucral glume, but ciliate, pale short, deeply 2-fid with conspicuously auricled flaps, upper floral glume chartaceous, glabrous, delicately ciliolate upwards, 5-nerved, produced into a straight awn or mucronate, pale equal to the glume, 2-keeled, with broadly auricled flaps. Lodicules 2, broadly cuneate. Stamens 3. Styles distinct, stigmas laterally exserted. Grain enclosed by the glume and pale, elliptic-oblong, dorsally much compressed; scutellum about half the length of the grain; hilum basal, punctiform.

Species about 5.—In the tropics and the warm temperate zone of the Old World, 2 in India.

In the Bombay Presidency there is only one species:

1. **Alloteropsis cimicina**, Stapf in Prain Fl. Trop. Afr. ix, 487; Haines in Bot. Bihar & Orissa 1009.—*Milium cimicinum*, Linn. Mant. Alt. 184.—*Panicum cimicinum*, Retz. Obs. iii, 9; Roxb. Fl. Ind. i, 295; Steud. Syn. Pl. Glum. i, 43.—*P conjugatum*, Dalz. & Gibs. Bomb. Fl. 291.—*Axonopus cimicinus* (?), Beauv. Agrost. 154; Hook. f. in F. B. I. vii, 64; Hook. f. in Trim. Fl. Ceyl. v, 166; Cke. ii, 925.—*Urochloa cimicina*, Kunth Rev. Gram. i, 31, t. 103; Dalz. & Gibs. l. c 289.—*Cordiochloa cimicina*, Nees in Edinb. N. Phil. Journ. xv (1833), 381; A. Chase in Proc. Biol. Soc. Wash. xxiv, 158.—*C. fimbriata*, Nees ex Wight Cat. no. 1656; Aitchis. Cat. Panjab, Pl. 158.

Description: Cke. l. c.

Locality: *Konkan*: Sewri (McCann 3586!); Mulgaum (McCann 3654!).—*Deccan*: Sinhagad forests (Bhide!); Lina Hill, Nasik District (Blatter &

Hallberg 4583 !) ; Panchgani (Hallberg !).—*S. M. Country* : Dharwar (Sedgwick 2032 !, Woodrow) ; Gokak (Shevade !) ; Badami (Woodrow).—*Kanara* : Halyal (Talbot 2294 !) ; Kulgi (Talbot 2434 !).

Distribution : Tropical Africa, Madagascar, throughout India to Java.

44. ERIOCHLOA, H. B. & K. ; Cke. ii, 944.

Species about 25.—In the warm parts of the whole world.

Cooke describes one species : *E. polystachya*, H. B. & K. which name has to cede to *E. ramosa*, O. Kuntze.

1. **Eriochloa ramosa**, O. Kuntze Rev. Gen. Pl. ii, 775 ; Hack. in Bull. Acad. Int. Bot. xvi, 19 ; Merrill in Philipp. Journ. Sc. i, Suppl. 348 ; Stapf in Prain Fl. Trop. Afr. ix, 498 ; Haines in Bot. Bihar & Orissa 1006.—*E. annulata*, Kunth Rev. Gram. i, 30, and Enum. i, 73 ; Duthie List Grass. N. W. Ind. 2 ; Benth Fl. Hongk. 409 ; Hack. in Engl. Jahrb. vi, 233.—*E. polystachya*, Duthie, Ill. Indig. Fodd. Grass. Ind. t. 41 ; Fodd. Grass. N. Ind. 2 ; Hook. f. in F.B.I. vii, 20 ; Cke. ii, 944 ; Rendle in Journ. Linn. Soc. Bot. xxxvi, 320 (*non* H. B. & K. !).—*Milium ramosum*, Retz. Obs. vi (1791), 22 ; Roxb. Fl. Ind. i, 317 ; Griff. Notul. iii, 15 ; Ic. Pl. Asiat. t. 139, f. 60.—*Agrostis ramosa*, Poir. Encycl. Suppl. i, 257.—*Paspalum annulatum*, Fluegge Monogr. Pasp. 133 ; Trin Sp. Gram. Ic. t. 133.—*Helopus lævis*, Trin. ex Spreng. Neue Entdeck. ii, 49, fig. 4.—*H. annulatus*, Steud. Syn. Glum. i, 99 (*non* Nees).—*Pipatherum annulatum*, Presl, Rel. Haenk i, 221 (*non* Raddi).

Note.—Masaja Honda in his Revisio Graminum Japoniæ (Bot. Mag. Tokyo 37 (1923), 113-124) is of opinion that *Eriochloa ramosa*, O. Kuntze, has to be partly emended and changed to the new species *Eriochloa Hackelii*. Details are wanting to form an opinion on this point.

Description : Cke. l. c.

Locality : *Sind* : Umerkot, in a garden (Sabnis B718 !) ; Jamesabad, on banks of a watercourse (Sabnis B967 !) ; Bughar, Indus River (Blatter & McCann D691 !) ; Tatta, Kullan Kote Lake (Blatter & McCann D692 !) ; Tatta (Blatter & McCann D693 !).—*Gujarat* : Ahmedabad (Gammie 16408 !).—*Konkan* : Bassein (Bhide !) ; Antop Hill (McCann 3613 !) ; Alibag, rice field (Ezekiel, !) ; Bandra, on walls and in ditches (McCann !) ; Bombay (Hallberg A141 !) ; Bombay, near Mahim (Woodrow, Lisboa) ; Bhandup, in an old distillery compound, in a ditch (Hallberg A19 !).—*S. M. Country* : Shiggaon, elevation 2,000 ft., rainfall 34 inches (Sedgwick 2356 !) ; Kunnur, elevation 2,000 ft., rainfall 35 inches (Sedgwick & Bell 4937 !) ; Ranibenur (Bhide !) ; Dharwar (Sedgwick !).—*Kanara* : Halyal (Talbot !).

Distribution : Tropics of the Old World, introduced into Ascension Island, St. Helena, Cuba.

45. BRACHIARIA Griseb. in Ledeb. Fl. Ross. iv, 469 ; Stapf in Prain Fl. Trop. Afr. ix, 505.

(Sect. *Brachiaria* and part of sect. *Paspaloideæ* of *Panicum* of the F.B.I.).

Perennial or annual. Leaf-blades linear to lanceolate, usually flat ; ligules reduced to a narrow ciliate or ciliolate rim. Racemes usually subsessile and solitary on a common axis, sometimes bare at the base owing to the arrest of spikelets, rarely truly peduncled and panicled, simple or compound near the base, rarely to or beyond the middle ; rhachis filiform, triquetrous or more or less flattened and herbaceous with a wavy or zig-zag midrib, which projects as a mostly acute keel on the face ; pedicels solitary or in pairs, alternately to the right and the left of the facial angle or the midrib, if solitary all short or very short, if paired, the primary slightly to very much longer ; spikelets closely appressed, always biseriate in the plane, but frequently becoming 1-seriate by the dovetailing of the alternate spikelets of the closely approximate ranks, more or less contiguous with their sides or imbricate, forming dense, spike-like racemes, or distant by almost their own length or more, glabrous or hairy. Spikelets more or less elliptic or oblong, more or less flattened or slightly depressed, convex on the base, falling entire from the pedicels, 1-2-, rarely more-nate, secund and adaxial (with lower involucral glume towards the axis and the convex side of the upper floral glume away from the axis), closely appressed to and 2-seriate on the triquetrous or flat rhachis of spiciform racemes ; lower floret male or barren with a usually well-developed pale, very rarely the latter suppressed. Involucral glumes dissimilar and mostly very unequal in length. Lower involucral glume shortest ; upper resembling and more or less equalling the lower floral glume, 5-7- (rarely 9-) nerved. Lower floral glume 5-, rarely 7-nerved, the lateral nerves placed towards the margins and distant from the middle nerve ; pale usually only slightly shorter than the valve with well-developed inflexed flaps, or the latter vanishing above the middle; upper floral glume oblong to elliptic in outline, emucronate, though sometimes contracted into an apiculus, crustaceous or subcoriaceous with firm involute margins, faintly 5-nerved ; pale almost as long as the glume, 2-keeled, its sides tightly embraced by the valve. Lodicules 2, small, broadly cuneate. Stamens 3. Styles distinct ; stigmas plumose, laterally exserted from the upper part of the spikelet. Grain tightly enclosed by the glume and pale, more or less flattened on both faces ; hilum subbasal, punctiform ; embryo half to over ¾ the length of the grain.

Species about 80. In the warm parts of the whole world, but chiefly in Africa.

Cooke mentions 3 species which belong to this genus : *Panicum Isachne*, *P. ramosum* and *P. muticum*. To these we add *Brachiaria distachya* (*Panicum distachyum*).

A. Spikelets 0·5 mm. long or slightly more ... 1. *B. Isachne*.
B. Spikelets 2·5–4 mm. long
  I. 90 cm. to 1·8 m. high ... ... 2. *B. mutica*.
  II. Less than 80 cm. high
    1. Spikes 5–many ... ... 3. *B. ramosa*.
    2. Spikes 2–4 ... ... 4. *B. distachya*.

1. **Brachiaria Isachne**, Stapf in Prain Fl. Trop. Afr. ix, 552 ; Haines in Bot. Bihar & Orissa 1004 (*habet Roth per errorem*).—*B. cruciformis*, Griseb. in Ledeb. Fl. Ross. iv, 469.—*Panicum Isachne*, Roth ex Roem. & Schult. Syst. ii, 458 ; Roth Nov. Pl. Sp. 54 ; Schult. Mant. ii, 252 ; Steud. Syn. Pl. Gl. i, 57; Hook. f. in F.B.I. vii, 28 ; Stapf in Dyer Fl. Cap. vii, 390 ; Cke. ii, 931.—*P. cruciforme*, Sibth. & Sm. Fl. Græca i, t. 59 ; Baker Fl. Maurit. 434 ; Schweinf. in Bull. Herb. Boiss. ii, App. ii, 19 ; Duthie Grass. N.W. Ind. 3, Indig. Fodd. Grass. t. 43, Fodd. Grass. N. Ind. 6 ; Boiss. Fl. Or. v, 437.—*P. caucasicum*, Trin. Sp. Gram. Ic. t. 262.—*P. Wightii*, Nees Fl. Afr. Austr. 29.—*P. pubinode*, Hochst. ex. A. Rich. Tent. Fl. Abyss. ii, 363.—*Echinochloa cruciformis*, Koch in Linnæa, xxi, 437 ; Reichb. Ic. Fl. Germ. i, t. 29, fig. 1413.

Description : Cke. ii, 931.

Locality : *Sind* : (Herb. Econ. Bot. Poona !).—*Gujarat* : Surat (Chibber !, Dalzell *teste* Cooke).—*Khandesh* : Sungiri (Gammie 16552 !) ; Dhulia Farm (Chibber !) ; Chanseli (McCann A92 !) ; Nimb, Tapti Bank (Blatter & Hallberg 9571 !) ; Dadgaum (McCann 9562 !) ; Tapti, Bhusawal (Blatter & Hallberg 5156 !) ; Umalla village (Blatter & Hallberg 5159 !) ; Bor, Bori River (Blatter & Hallberg 4424 !).—*Konkan* : Clerk Rd., Bombay, along brackish water (Sabnis 9565 !); very common in Bombay and Salsette Islands (McCann !).—*Deccan* : Yeola (Herb. Econ. Bot. Poona !) ; Mangiri, 8 miles E. of Poona (Gammie !) ; Sholapur (D'Almeida A91 !) ; Deolali (Blatter 9570 !, 9569 !) ; Khandala, common (McCann 9566 !) ; Purandhar, N. foot (McCann 9568 !) ; Panchgani, below Sidney Point (Blatter & Hallberg 1271 !).—*S. M. Country* : Nelogi, elevation 1,800 ft., rainfall 30 inches (Sedgwick 2134 !) ; Haveri (Talbot 2150 !).—*Kanara* : Halyal (Talbot 2150 !).

Distribution : Throughout the plains of India in damp places, Ceylon, westwards to Italy and tropical and S. Africa.

*2. **Brachiaria mutica**, Stapf in Prain Fl. Trop. Afr. ix, 526.—*Panicum muticum*, Forsk. Fl. Aegypt.—Arab. 20 ; Link Hort. Berol. I, 206 ; Hook. f. in F. B. I. vii, 34, and in Trim. Fl. Ceyl. V, 140.— *P. numidianum*, Lam. Ill. I, 172 ; Boiss. Fl. Or. v, 438.— *P. purpurascens*, Raddi ex Opiz in Flora (1822), 266.—*P. barbinode*, Trin. Sp. Gram. Ic. t. 318 ; Duthie List Grass. N. W. Ind. 2.— *P. sarmentosum*, Benth. in Hook. Niger Fl. 561 (*non* Roxb.).— *P. equinum*, Steud. Syn. Pl. Glum. i, 73.— *P. molle*, Griseb. Fl. Brit. West Ind. 547 (excl. syn.); Baker Fl. Maurit. 436.

In adopting Forskal's name '*muticum*' for this species Stapf, according to his own words, has relied on Ascherson's indentification (Asch. & Schweinf. Ill. Fl. Egypt 160) of the type with the Algerian *P. numidianum*.

Popular Names : Water Grass, Mauritius Grass, Para Grass, Scotch Grass, Buffalo Grass.

Description : Perennial 1–2·5 m. high. Stems ascending from a sometimes prostrate and copiously rooting base, stout, terete, usually many-noded and sheathed high up, simple or sparingly branched, glabrous, often waxy, pruinose below the nodes. Leaf-blades linear, up to 30 cm. long, 6–10 mm. broad glabrous or rarely more or less hirsute, margins scabrid. Panicle oblong to ovate-oblong in outline subsecund or almost quaquaversal, 6-20 cm. long; common rhachis terete to semiterete, more or less deeply channelled or triquetrous upwards, scabrid along the angles, glabrous. Racemes numerous, solitary or irregularly approximate, sometimes paired or in false whorls, shortly peduncled or subsessile, obliquely spreading, 7 (rarely 12) to 2·5 cm. long, mostly compound, glabrous, greenish or tinged with purple ; rhachis flat, with a slender, raised midrib up to 1 mm. wide, villosulous at the base, otherwise glabrous ; secondary racemes usually very short, and 6–3-spiculate ; pedicels solitary or paired, very short, or if paired then the longer up to 1 mm. long, frequently with a few setules. Spikelets laterally contiguous or discontiguous, those of the secondary racemes often imbricate, oblong or lanceolate-oblong, acute, 3–3·5 mm. long, glabrous. Involucral glumes dissimilar, lower broad-ovate, acute to subacute, from less than $\frac{1}{3}$ to not quite $\frac{1}{2}$ the length of the spikelet, faintly 3–5-nerved, often tinged with purple ; upper corresponding in outline and size to the spikelet, 5–7-nerved. Lower floral glume as long as the upper involucral glume and similar to it ; pale narrowly oblong, subacute, almost as long as the glume, with narrow flaps ; anthers 2 mm. long ; upper floral glume slightly shorter than the spikelet, mostly 3 mm. long, oblong, subacute or minutely apiculate, pale yellowish, glume and pale crustaceous, very finely transversely wrinkled or almost smooth. Stigmas blackish-purple, very conspicuous.

Locality : Cultivated at Kirkee and Surat (Woodrow) and very likely in other places.

Distribution : A native of S. America and W. Africa, but introduced elsewhere (Stapf).

Uses : A fodder grass. See Kew Bull. (1894), 384.

3. **Brachiaria ramosa**, Stapf in Prain Fl. Trop. Afr. ix, 542 ; Haines Bot. Bihar & Orissa 1005.—*Panicum ramosum*, Linn. Mant. (1767), 29 ; Steud. Syn. Pl. Glum. i, 97 ; Hook. f. in F.B.I. vii, 36 (*partim*) ; Trim. Fl. Ceyl., v, 140 ; Prain Beng. Pl. 1175 ; Cke. ii, 932.—*P. arvense*, Kunth Rev. Gram. i, 391, t. 109.—*P. Petiveri*, Dis. ii, 144. (*partim*) ; Baker Fl. Maurit. 434 ; Aitchis. Cat. Panjab Pl. 160 ; Duthie Grass. N. W. Ind. 6, Fodd. Grass. N. Ind. 11 ; Boiss. Fl. Or. v, 439.—*P. brachylachnum*, Steud. l c. 62.—*P. cognatissimum*, Steud. l.c. 69.—*P. patens*, Boj. Hort. Maurit. 365 (*non* Linn.).—*P. pygmaeum*, Boj. l.c.—*P. Helopus*, Watt. Dict. Econ. Prod. vi, part 1, 10 (*partim*).—*P. umbrosum*, Retz. Obs. 4 (1786), 16 ; Roxb. Fl. Ind. i, 297.

Description : Cke. ii, 932.—Stapf points out that this species occurs in a glabrous and a pubescent state, and that the original specimen in Linnæus' herbarium represents the former. 'The pubescence,' he says, 'if present, extends generally to the culms, the leaves, the axes of the inflorescence and the spikelets, the upper glume [upper involucral glume] and lower valve [lower floral glume]. On the blades it may be scanty and disappear with age. It does not seem to be correlated with any other character, and the area of the glabrous and pubescent states overlap completely, in fact both have been taken in the same collecting.'

He mentions another curious modification in which the lower floral glume is more firmly membranous to crustaceous and faintly transversely rugose and thus more or less resembles the upper floral glume (not the upper involucral glume as is normally the case). It has been collected in India and W. Africa.

Locality : *Sind* : Chachra (Mamlatdar of Chachra !) ; Shahabander (Karachi P.O.C. of Shahabander !) ; Sangarh (Sabnis B901 !, B887 !) ; Nasarpur, clayey soil (Sabnis B1057 !).—*Gujarat :* Ahmedabad (Herb. S.X.C. 2165 !); Mausari (Mamlatdar of Mausari !) ; Sumrasar, Cutch (Blatter 3756 !).—*Khandesh* : Tamer, Tapti bank (Blatter & Hallberg 5172 !) ; Antroli, Bori River (Blatter & Hallberg 5149 !) ; Toranmal (McCann A142 !).—*Konkan* : Malabar Hill (McCann !) ; Versova (McCann 9588 !) ; Byculla (McCann 9586 !) ; Sion (McCann 8689 !) ; Bandra Hill, in fallow fields (Vakil A115 !).—*Deccan* : Khandala (Sedgwick 2631 !) ; Poona (Woodrow !) ; Lina Hill, Nasik District

(Blatter & Hallberg A145 !).—*S. M. Country*: Dharwar, garden weed (Sedgwick 2651 !); Haveri (Talbot 2231 !); Badami (Woodrow *teste* Cooke).

Distribution: Throughout India, Ceylon, Afghanistan, tropical Africa (Upper Guinea, Cape Verd Islands).

4. **Brachiaria distachya**, Haines in Bot. Bihar & Orissa 1004 (*per errorem distachyum*).—*Panicum distachyum*, Linn. Mant. i, 138; Retz. Obs. iii, 17; Lamk. Ill. t. 43, f. 2; Steud. Syn. Gram. 41; Aitchis. Cat. Panjab, Pl. 159; Duthie Grass N. W. Ind. 3; Indig. Fodd. Grass. t. 42, Fodd. Grass. N. Ind. 6; Benth. Fl. Austral. vii, 478; Hook. f. in F.B.I. vii, 37.—*P. subquadriparum*, Trin. Gram. Panic. 145, Sp. Gram. Ic. t. 186.—*Digitaria distachya*, Pers. Syn. i, 85.

Description: A slender, creeping grass, glabrous or panicle sparsely hairy. Stems 30–60 cm. high. Leaves linear or lanceolate or linear-lanceolate, acuminate, 5–15 cm. by 3–6 mm., widest at the rounded or amplexicaul base, flat; sheaths ciliate or not on the margins, mouth hairy. Spikes 2–4, distant, 2·5–6·5 cm. long, rarely more than 10 cm., erect, at last spreading; rhachis slender, glabrous. Spikelets variable in size, pale green, 3–4 mm. long, solitary, subsessile, spikately arranged in 2 (–1) series, ellipsoid, glabrous. Lower involucral glume embracing the spikelet and margins overlapping below, $\frac{1}{3}$ to nearly $\frac{1}{2}$ the spikelet, 5–7-nerved, obtuse or subacute; upper involucral glume ovate, acute, 7-nerved, paleate or not, pale if present narrow, neuter. Lower floral glume 5-nerved, upper ellipsoid, obtuse or rounded, 2 mm. long, brown and minutely transversely lineolate or obscurely rugulose when ripe.

Locality: *Gujarat*: Ahmedabad, banks and margins of fields around Ahmedabad (Sedgwick 239 !).—*S.M. Country*: Dharwar (Sedgwick 2840 !).

Distribution: India, Ceylon, China, Malaya, Australia.

46. PASPALUM, Linn. Syst. Nat. ed. x, 855; Cke. ii, 943.

Species over 200, chiefly in tropical America, only a few in the Old World.

Cooke describes 3 species: *P. scrobiculatum*, Linn., *P. compactum*, Roth. and *P. distichum*, Linn., to which we add *Paspalum dilatatum*, Poir. *P. distichum* has to be replaced by *P. vaginatum*, Sw., for reasons detailed below.

I. Leaves over 14 cm. long
  1. Plant 60–90 cm. high ... ... 1. *P. scrobiculatum.*
  2. Plant 1–1·5 m. high ... ... 2. *P. dilatatum.*
II. Leaves less than 11 cm. long
  1. Leaves 2·5–7·5 cm long, 8–12 mm. broad ... ... 3. *P. compactum.*
  2. Leaves 5–10 cm. long, 1·2–4 mm. broad ... ... 4. *P. vaginatum.*

1. **Paspalum scrobiculatum**, Linn. Mantiss. (1767), 29; Hook. f. in F. B. I. vii 10; Cke. ii, 943; Haines in Bot. Bihar & Orissa 1000.—*P. scrobiculatum*, Linn. var. *Commersonii*, Stapf in Prain Fl. Trop. Afr. ix, 573.—*P. scrobiculatum*, Linn. var. *frumentaceum*, Stapf l. c. 575.—*P. scrobiculatum*, Linn. var. *polystachyum*, Stapf l. c. 576.—For further synonyms see Hook. f. and Stapf ll. cc. Hook f. gives *P. orbiculare*, Forst. Prodr. 7 as a synonym, but Stapf considers it as a distinct species of the Polynesian and Indo-Malayan regions with an extension into New Zealand and Australia. Of Hook. f. syn. in the F. B. I. we wish to enclose only those which apply to spontaneous forms of the Old World.

As can be seen from the above synonymy we are not following Stapf in distinguishing several varieties or rather forms. He takes the cultivated forms of India to be the original *P. scrobiculatum* of Linnæus and calls it *P. scrobiculatum* var. *frumentaceum*. All the spontaneous forms of *P. scrobiculatum* as understood by most post-Linnæan authors are put by Stapf under *P. scrobiculatum*, Linn. var. *Commersonii*, the type for this combination being *P. Commersonii*, Lam. Ill. i, 175, t. 43, fig. 1. The third form var. *polystachyum* does not seem to occur in India.

Description: Cke. l. c.

Locality: *Sind*: Jamesabad, in bed of watercourse (Sabnis B979 !); Bohara (Blatter & McCann D689 !).—*Konkan*: Victoria Gardens, Bombay (McCann 4297 !); Mulgaum, Salsette (McCann 3607 !); Parsik, between stones of railway tract (McCann 9516 !); Vihar Lake, Salsette (McCann 9517 !).—*Deccan*:

Khandala, in watercourse, on sandy soil (McCann 9824 !).—*S. M. Country*: Konankeri, Dharwar District, elevation 1,800 ft., rainfall 40 inches (Sedgwick & Bell 4966 !) ; W. of Dharwar, elevation 2,000 ft. rainfall 40 inches (Sedgwick & Bell 4452 !) ; Dastikop, elevation 2,500 ft., rainfall 35 inches (Sedgwick 2109 !) ; Dharwar (Garade !) ; Belgaum (Herb. Bot. Gard. Cal. !).—*Kanara* : Halyal (Talbot 2297 !) ; Karwar (Herb. Econ. Bot. Poona 2297 !, 618 !) ; Castle Rock (Gammie !).

Distribution : Tropics of the Old World.

*2. **Paspalum dilatatum,**[1] Poir. Encycl. v, 35 ; New South Wales Agric. Gaz. x (1899), 32, with plate ; Trin. Diss. 11, 113, with plates ; Agric. Grass. U. S. 31-32 ; H. H. Mann in Dept. Agric. Bomb. Bull. 77, 68.—*P. ovatum*, Nees ex Trin. Gram. Panic. 113.—*P. pratense*, Spreng Syst. i, 247.—*P. Selloi*, Spreng. ex Nees Agrost. Bras. 43.

Popular Names : Golden Crown Grass, Hairy-flowered Paspalum.

Description : A tall, erect grass, about 1–1·5 m. high. Culm developing from a thick rootstock with 3–5 leaves ; leaf at base of culm often about 30 cm. long, 8–12 mm. broad, smooth on both sides, rugose along the margins. Raceme 12–30 cm. long, having 5-10 somewhat spreading spikes, which are 7 cm. or more in length, 2·5–5 cm. apart, upper ones gradually shorter. Spikelets closely arranged in 4 rows, two on each side of the narrow and nearly straight axis in alternate pairs, 1·5–2 mm. wide, and 3–4 mm. long, ovate, acutely pointed, crowded and overlapping each other, compressed, margins clothed in silky hairs. Involucral glumes ovate, acute, 5-nerved, nearly smooth except the fringe of white hairs on the margin. Floral glumes thick, hard, and firm, very minutely punctate. Pale fitting inside the flowering glume and enclosing the stigmas and styles. Anthers linear. Styles 2 ; stigmas blackish-purple, plumose.

Locality : Cultivated. See Mann, l. c.

Distribution : Virginia, Mississippi, Louisiana, Texas, S. America, especially Brazil.

Uses : One of the best fodder grasses in N. America and is extensively cultivated there. For a full account see Kew Bull. (1902), 1-4.

3. **Paspalum compactum,** Roth Nov. Pl. Sp. (1821), 36 ; Kunth Enum. Pl. i, 61 ; Steud. Syn. Gram. 31 ; Hook. f. in F. B. I. vii, 12 ; Cke. ii, 943.—*P. miliaria*, C. Muell. in Bot. Zeit. xix (1861), 325.—*P. Canaræ*, Steud. l. c. 58.—*P. imperfectum*, Roxb. ex Kunth l.c.

Description : Cke. l.c.

Locality : *Konkan* : Tiwari-Pada, Bassein (Herb. Econ. Bot. Poona 1690 !) ; Matheran, to Louisa Point (D'Almeida A243 !).—*Deccan* : Khandala, growing in gravelly soil, very common (McCann 9823 !) ; Igatpuri, very common (McCann 4587 !); Panchgani, First Tableland (McCann B1300! B1265 !), Second Tableland (McCann B1242 !, B1292 !) ; Mahableshwar (Cooke, Woodrow).—*S. M. Country* : Londa (Bhide !) ; Belgaum (Hole 15 !).—*Kanara* : Yellapore (Talbot 657 !) ; Tinai (Talbot 2566 !) ; Castle Rock, elevation 1,900 ft., rainfall 250 inches (Sedgwick 2752 !) ; Karwar, Bingy Ghat (a very villious form, McCann) (Talbot 1529 !) ; Devimani, elevation 1,300 ft. (McCann A17 !).

Distribution : W. Peninsula of India.

4. **Paspalum vaginatum,** Sw. Prodr. Veg. Ind. Occ. 21, Fl. Ind. Occ. i, 135 ; Trin. Gram. Pan. 94, Panic. Gen. 53, Sp. Gram. Ic. t. 120 ; Kunth Enum. i, 52 ; Steud. Syn. Pl. Glum. i, 20 ; Hitchcock & Chase in Contrib. U. S. Nat. Herb. xviii, 307 (*non* P. Beauv. Fl. Owar.) ; Stapf in Prain Fl. Trop. Afr. ix, 570.—*P. vaginatum, forma longipes*, Lange in Vidensk. Medd. Naturh. Foren. Kjöbenh. (1854), 42, Pug. Pl. Hisp. i, 28.—*P. distichum*, N. L. Burm. Fl. Ind. 23 ; Gaertn. Fruct. ii, 2, t. 80 ; Kunth l. c. ; Steud. l. c. 29 ; Baker Fl. Maurit. 431 ; Benth. Fl. Austr. vii, 460 ; Hack. in Forschungsr. S. M. S. 'Gazelle' iv, 6 ; Hook. f. in F. B. I. vii, 12 ; Rendle in Journ. Linn. Soc. Bot. xxxvi, 319 ; Cke. ii, 943 ; Ridley Mat. Fl. Mal. Pen. iii, 124 ; Stapf in Dyer Fl. Cap. vii, 371 ; Merrill in Philipp. Journ. Sc. i, Suppl. i, 346 (*non* Linn.).—*P. distichum*, var. *vaginatum*, Griseb. Fl. Brit. W. Ind. 541.—*P. littorale*, R. Br. Prodr. 188 ; Trin.

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[1] We have to thank Mr. K. Biswas, the Curator of the Herbarium of the Sibpur Botanic Garden, for most of the information contained under this species.

Gram. Pan. 95, Sp. Gram. Ic. t. 112.—*P. longiflorum*, P. Beauv. Fl. Owar. ii, 46, t. 85, fig. 2; Grah. Cat. Bomb. 234 (*non* Retz.).—*P. brachiatum*, Trin. ex Nees Agrost. Bras. 62.—*P. foliosum*, Kunth Rev. Gram. i, 25.—*P. squamatum*, Steud. l. c. 21.—*P. inflatum*, A. Rich. in Ram. de Sagra Fl. Cub. iii, 298.—*P. kleinianum*, Presl Rel. Haenk. i, 209.—*P. Boryanum*, Presl l. c.—*Digitaria foliosa*, Lag. Gen. *et* Sp. Nov. 4.—*D. vaginata*, Philippe Fl. d. Pyren. ii, 415.—*D. paspaloides* var. *longipes*, Lange ex Willk & Lange Prodr. Fl. Hisp. i, 45.—*Sanguinaria vaginata*, Bub. Fl. Pyren. iv, 258.

To explain the change of name from *P. distichum*, Linn. to *P. vaginatum*, Sw., and to elucidate certain points of the above synonymy taken from Stapf, it will suffice to quote the short explanation given in the Fl. Trop. Afr. p. 572: 'Frequently confused with *Paspalum distichum*, Linn. (Herb. Linn.!) which has broader and flatter leaves, mostly sessile or subsessile lateral spikes and spikelets with firmer sides and a more convex upper glume, which is appressedly and silky pubescent.'

Description: Cke. ii, 943.

Locality: *Gujarat*: Marshy edge of the Bokh, Prantij (Herb. Econ. Bot. Poona!).—*Konkan*: Marine Lines, Bombay (Hallberg 9514!); sea-shore, Bombay (Woodrow); Malabar Hill, Bombay (McCann 3609!); St. Xavier's College compound (McCann 9830!); Alibag, sandy shore (Ezekiel!); Malwan (Woodrow).

Distribution: Tropics of the whole world, mostly on the sea-shore; introduced into Galicia (Spain) and the Western and Central Pyrenees.

47. PASPALIDIUM, Stapf in Prain Fl. Trop. Afr. ix (1917), 15 *clavi et l. c.* (1920), 582.

(Sect. *Paspaloideæ* in F. B. I. *partim*).

Perennial, semiaquatic or terrestrial. Leaves linear, flat or involute. Ligule a ciliolate rim. Racemes sessile or sub-sessile and secund on the alternate notches of a triquetrous common axis of a false compound spike, more or less appressed to the more or less hollowed-out flanges of the latter. Rhachis ending in a subulate point. Spikelets mostly conspicuously 2-seriate, nearly always quite glabrous, ovate to ovate-oblong or ovate-lanceolate (when seen in front view), awnless, falling entire from the pedicels, solitary, secund and abaxial on the rhachis. Involucral glumes mostly dissimilar and very unequal in length; lower reduced to a small scale or up to, rarely over, half the length of the spikelet, upper mostly almost equalling the spikelet, 5-7-nerved with the nerves evenly distributed, rarely both glumes much reduced. Lower floral glume similar to the upper involucral glume with the inner side-nerves more distant, pale if present only slightly shorter than its glume with well developed inflexed flaps; upper floral glume oblong to elliptic in outline, acute to apiculate; emucronate, crustaceous with firm involute margins, faintly 5-nerved, pale almost as long as its glume, 2-keeled, its sides tightly embraced by the glume all along. Lodicules 2, small, broadly cuneate. Stamens 3. Styles distinct; stigmas plumose, laterally exserted from the upper part of the spikelet. Grain tightly enclosed by the more or less hardened glume and pale.

Species about 12.—In the warm countries of the whole world. Six are confined to Australia and New Caledonia.

Cooke (ii, 929) describes 3 species belonging to this genus: *Panicum flavidum*, Retz., *P. punctatum*, Burm., and *P. fluitans*, Retz. We retain all, but substitute the older name *geminatum* for *fluitans*.

I. Lower spikes shorter than the internodes. Upper involucral glume shorter than the upper floral glume ... ... 1. *P. flavidum*.
II. Lower spikes as long as or longer than the internodes. Upper involucral glume about ½ the upper floral glume ... ... 2. *P. punctatum*.
III. Lower spikes as long as or shorter than the internodes. Upper involucral glume mostly as long as the upper floral glume ... ... 3. *P. geminatum*.

1. **Paspalidium flavidum**—A. Camus in Lecomte Fl. l'Indo-Chine, vii 1, 419; Haines in Bot. Bihar & Orissa 1001 (*erronee attribuens combinationem Stapfio*).—*Panicum flavidum*, Retz. Obs. iv (1786), 15; Griff. Notul. iii, 33; Ic. Pl. As. t. 139, fig. 67; Duthie Grass. N. W. Ind. 3, Indig. Fodd. Grass. t. vi,

Fodd. Grass. N. Ind. 7 ; Benth. Fl. Austr. vii, 474 ; Hook. f. in F.B.I. vii, 28 ; Cke. ii, 929.—*P. brizoides*, Jacq. Eclog. Gram. (1813), 2, t. 2; Roxb. Fl. Ind. i, 293 ; Dalz. & Gibs. Bomb. Fl. 290 ; Duthie Grass. N. W. Ind. 2 ; Aitchis. Cat. Panjab Pl. 159 ; Baker Fl. Maurit 433.—*P. floridum* Royle Ill. Bot. Himal. 420.

Description : Cke. ii, 929.

Locality : *Sind :* Sanghar (Sabnis B762!).—*Gujarat:* Near Surat (Dalzell & Gibson *teste* Cooke) ; Morvi, Kathiawar (Woodrow *teste* Cooke) ; Porbandar, Kathiawar (Woodrow *teste* Cooke).— *Konkan* : Mulgaum (McCann 9579 !); Thana (McCann 8726!) ; N. & S. Konkan (Laws *teste* Cooke).— *Deccan* : Poona (Bhide !) ; Mr. Gammie's compound, Kirkee (Bhide 894 !) ; Khandala (Woodrow *teste* Cooke !).— *S. M. Country* : Konankeri, in a small tank, elevation 1,800 ft., rainfall 40 inches (Sedgwick & Bell 4964 !) ; Belgaum (Herb. Econ. Bot. Poona !).—*Kanara* : Yellapore (Talbot !) ; Halyal (Talbot 2095 !).

Distribution : Plains of India, Ceylon, tropical Asia (not in tropical Africa as reported by Hook. f. and Cooke).

2. **Paspalidium punctatum,** A. Camus in Lecomte Fl. l'Indo-Chine, vii, 419 ; Haines in Bot. Bihar & Orissa 1001 (*erronee attribuens combinationem Stapfio*).—*Panicum punctatum*, Burm. Fl. Ind. (1768), 26 ; Hook. f. in F.B.I. vii, 29 ; Cke. ii, 929.

Description : Cke. l.c.

Locality : *Deccan* : Poona (Woodrow, Lisboa) ; Ahmednagar (Woodrow).

Distribution : Throughout India in marshes, Ceylon, Malaya (not in tropical Africa).

3. **Paspalidium geminatum**, Stapf in Prain Fl. Trop. Afr. ix (1920), 583 ; Haines in Bot. Bihar & Orissa 1002.—*Panicum geminatum*, Forsk. Fl. Aegypt.—Arab. 18 ; Schweinf. in Bull Herb. Boiss. ii, App. ii, 19 ; Hack. in Bull Herb. Boiss. iv, App. iii, 14 ; Hitchcock & Chase in Contrib. U.S. Herb. xv, 30.—*P. fluitans*, Retz. Obs. iii, 8 *et* v, 18 ; Willd. Sp. Pl. i, 338 ; Kunth Enum. i, 78 ; Steud. Syn. Pl. Glum. i, 59 ; Miq. Fl. Ind. Bat. iii, 455 ; Baker Fl. Maurit. 433 ; Cke. ii, 929.—*P. brizoides*, Lam. Ill., 1, 170 (*non* Retz.).—*P. paspaloides*, Pers. Syn. i, 81 ; Kunth Enum. i, 77 ; Steud. l.c. 60 ; Boiss. Fl. Or. v, 436 ; Balfour f. Fl. Socotra 310 ; Hook. f. in F.B.I. vii, 30, in Trim. Fl. Ceyl. v, 135.—*P. beckmanniæforme*, Mikan ex Trin. in Spreng. Neue Entdeck. ii, 83 ; Spreng. Syst. i, 309.—*P. truncatum*, Trin. Diss. ii. 130, *et* Sp. Gram. Ic. t. 168. —*P. affine*, Nees Agrost. Bras. 113.—*P. brizaeforme*, Presl Rel. Haenk. 302 ; Steud. l.c. 60.—*P. numidianum*, Sieb. ex Schult. Mant. ii, 267 (*non* Lam.). *P. carnosum*, Salzm. ex Steud. l.c.—*P. appressum*, Doell. in Mart. Fl. Bras. ii, ii, 184.—*P. glomeratum*, Buckl. Prel. Rep. Geol. Agr. Surv. Tex. app. 3 (*non* Moench.).—*P. turgidum*, Cheval Sudania 25.—*Paspalum appressum*, Lam. Ill. i, 176.—*Digitaria appressa*. Pers. l.c. 85.—*D. affinis*, Roem. & Schult. Syst. ii, 470.

Description : Cke. ii, 929.

Locality : *Sind* : Munchar Lake (Stocks *teste* Cooke) ; Tatta (Blatter & McCann D611 !, D612 !).—*Gujarat* : Porbandar (Bhide !) ; Lasundra (Chibber!); Ahmedabad, canal banks (Sedgwick !) ; Cutch, Anjar, tank (Blatter 3745 !).—*Khandesh* : Dhulia (Chibber !) ; Borod, growing in water, partly submerged (McCann A97 !).—*Konkan* : Mahaluxmi (Sabnis 5449 !) ; opposite Kantwadi, sandy shore, Bandra (Vakil A99 !) ; Victoria Gardens (McCann A100 !) ; common in Bombay Isl. (McCann !).—*Deccan* : Bund Gardens, Poona (Garade 343 !) ; sides of stream Dangar Guy, Ahmednagar (T. Cooke 6 !) ; Manmad, river bed (Blatter A94 !) ; Sholapur Tank, in water (D'Almeida A95 !) ; Pashan (Gammie !) ; Igatpuri (Blatter & Hallberg 5492 !).—*S. M. Country* : Dharwar (Sedgwick 3692 !) ; Shiggaon (Sedgwick 2081 !).—*Kanara* : Halyal (Talbot 2149 !).

Distribution : More or less throughout India, Ceylon, Afghanistan, Arabia, tropical Africa and America.

48. UROCHLOA, Beauv. Agrost. 52, t. xi, fig. 1 ; Stapf in Prain Fl. Trop. Afr. ix, 586.

Perennial or annual. Leaves linear to lanceolate, flat ; ligules a ciliate rim. Racemes sessile or subsessile on a common axis, simple or nearly so ; rhachis more or less triquetrous with a low almost straight or zigzag facial angle or keel, rarely strap-shaped; pedicels solitary or in pairs, alternately to the right and the left of the facial angle, usually reduced to short disc-tipped stumps, or if binate the primary slightly longer. Spikelets close, contiguous or slightly discontiguous, 2 or irregularly pluri-seriate, glabrous or hairy, broad-ovate to elliptic or lanceolate-oblong, awnless, usually more or less flattened or slightly depressed abaxially, convex on the back, falling entire from the pedicels, solitary or binate or in fascicles of 3-4, secund and abaxial on the rhachis involucral glumes similar and subequal or more often dissimilar and very unequal in length, the lower being the shorter, upper resembling and more or less equalling the lower floral glume, 5-11 (mostly 7-) nerved. Lower floral glume 5-7-, rarely more-nerved the inner lateral nerves somewhat distant from the midnerve, pale subequal to the glume, with well-developed inflexed flaps and sharp sometimes marginate keels; upper floral glume elliptic to rotundate-elliptic in outline, very obtuse, with usually scabrid or barbellate mucro, narrowly involute, 5-7-nerved, pale almost as long as the glume, 2-keeled, the sides tightly embraced by the valve all along. Lodicules 2, small, broadly cuneate. Stamens 3; styles distinct; stigma plumose, laterally exserted upwards. Grain tightly enclosed by the glume and pale, broadly to rotundate-elliptic, dorsally compressed.

"Very similar to *Brachiaria*, but with the orientation of the spikelets inverted and a short fine mucro from the very obtuse apex of the fertile valve. Although very similar in general appearance, none of the species of *Urochloa* can be said to approach closely members of the genus *Brachiaria*. Their affinities are clearly *inter se*, suggesting a distinct line of evolution. The occurrence of parallel states, one with glabrous, the other with pubescent spikelets, but otherwise indistinguishable, runs almost through the whole genus. To this may be added the presence of a submarginal fringe in the lower floret, almost normal in some and very rare in other species, and apparently in no case correlated with other characters." (Stapf l.c.).

Species about 18.—Hot parts of the Old World, one in America, but perhaps introduced.

Cooke describes 3 species of *Panicum* which belong here: *Panicum prostratum*, Lamk., *P. setigerum*, Retz., and *P. Javanicum*, Poir., to which we add *Urochloa marathensis*, Henrard.

A. Spikelets up to 2 mm. long ... ... 1. *U. reptans.*
B. Spikelets 2·5–5 mm. long
  I. Spikelets lanceolate, acuminate ... 2. *U. setigera.*
  II. Spikelets ovate to elliptic-oblong
    1. Leaves about 3 cm. long. Racemes 2 cm. long ... ... 3. *U. marathensis.*
    2. Leaves 3·5–15 cm. long. Racemes 2·5–5 cm. long ... ... 4. *U. Helopus.*

1. **Urochloa reptans**, Stapf in Prain Fl. Trop. Afr. ix, 601; Haines in Bot. Bihar & Orissa 1003.—*Panicum reptans*, Linn. Syst. Nat. ed. x, 870; Hitchc. & Chase in Contrib. U. S. Nat. Herb. xv, 36, fig. 17, excl. *P. grossarium*. –*P. repens*, N. L. Burm. Fl. Ind. 26, t. 11, f. 1; Rottl. in Neue Schrift. iv, 182; Roxb. Fl. Ind. i. 302; Boj. Hort. Maur. 364 (*non* Linn.).—*P. prostratum*, Lam. Ill. i, 171; Miq. Fl. Ind. Bat. iii, 446; Griseb. Fl. Brit. W. Ind. 546; Schweinf. in Bull. Herb. Boiss. ii, App. ii, 20; Baker Fl. Maur. 435; Duthie List. Grass. N. W. Ind. 6; Ill. Indig. Fodd. Grass. t. 45; Fodd. Grass. N. Ind. 11; Boiss. Fl. Or. v, 438; Dalz. & Gibs. 290; Hook. f. in F.B.I. vii, 33; Cke. ii, 932; Merrill in Philipp. Journ. Sc. i, 355.—*P. barbatum*, Lam. l. c. —*P. cæspitosum*, Sw. Fl. Ind. Occ. i, 146. —*P. Sieberi*, Link. Hort. Berol. i, 207. —*P. procumbens*, var. Nees Agrost. Bras. 109.—*P. crispum*, Llanos, Fragm. 42. –*P. insularum*, Steud. Syn. Pl. Glum. i, 61.—*P. calacczense*, Steud. l.c. 65. —*P. aurelianum*, Hale in Wood Classb. ed. iii, 787.—*P. viaticum*, Salzm. ex Doell in Mart. Fl. Bras. ii, ii, 155.—*P. marginatum*, Vahl ex. Hook. f. l. c.—*Brachiaria prostrata*, Griseb. in Abh. Ges. Wiss. Goett. vii, 263.

Description: Cke. ii, 932, under *Panicum prostratum*.

Locality: *Gujarat*: Ahmedabad, famine grass plot, Bedar (Herb. Gujarat College!); Ghad, on black soil (Sedgwick 1124!).—*Khandesh*: Nandurbar, (Mamlatdar of Nandurbar!); Umalla, Tapti bank (Blatter & Hallberg 5229!); Bor, Tapti (Blatter & Hallberg 4417!).—*Konkan*: Vasco da Gama (Bhide!); Matunga, salt pans (Sabnis 9572!); Byculla (McCann 9577!).—*Deccan*: Kirkee

(Bhide !) ; Poona (Herb. Econ. Bot. Poona !) ; Deolali (Blatter A107 !) ; Sholapur (D'Almeida A108 !, A109 !).—*S. M. Country*: S. W. of Dharwar, elevation 1,800 ft., rainfall 90 inches (Sedgwick & Bell 4437 !) ; Dharwar, under trees on black soil, elevation 2,400 ft., rainfall 34 inches (Sedgwick 2882 !).

Distribution : Plains of India, Ceylon, Tropics generally, subtropical America, also tropical Arabia and the Mascarenes.

2. **Urochloa setigera**, Stapf in Prain Fl. Trop. Afr. ix, 598 ; Haines in Bot. Bihar & Orissa 1003.—*Panicum setigerum*, Retz. Obs. iv, 15 ; Roxb. Fl. Ind. i, 299 ; Kunth Enum. i, 90 (*excl. syn. nonnullis*) ; Hook. f. in F. B. I. vii, 37 ; Trim. Fl. Ceyl. v, 141 ; Cke. ii, 933.—*P. affine*, Poir. Encycl. Suppl. iv, 273 (ex Kunth).

Description : Cke. ii, 933, under *Panicum setigerum*.

Locality : *Sind* : Mirpur Sakro (Blatter & McCann D609 !); Gharo (Blatter & McCann D610 !).-*Gujarat* : Rajkot, Kathiawar (Woodrow 45 *teste* Cooke!).—*Khandesh* : Dhulia (Herb. Econ. Bot. Poona !).—*Konkan* : Bassein (Paranjpe !). —*Deccan* : Ganeshkhind Bot. Gardens (Herb. Econ. Bot. Poona !) ; Mangiri Farm, 11 miles S. E. of Poona (Herb. Econ. Bot. Poona !).

Distribution : India, Ceylon, Mauritius, tropical and S. Africa.

Note : We do not think there is any good reason for retaining Hook. f.'s var. *tomentosa* which was also mentioned by Cke. l. c. We refer to the note given above after the general characteristics of the genus and add what Stapf says with regard to this species in particular : 'The African specimens have glabrous spikelets. In India, however, the pubescent form appears to be prevalent.'

3. **Urochloa marathensis**, Henr. in Mededeel. Rijks Herb. 43 (1922), 1-3, pl. 1. —*Panicum marathense*, Henr. in Herb. Lugd. Bat.

Distribution : Annual, dwarf and robust, glaucous, branching from the lower geniculations. Stems low, striate, quite glabrous, few-noded, nodes pubescent. Leaf-sheaths terete or slightly compressed, striate, lower ones gaping, upper ones tight, shorter than the internodes, hirsute with bulbous-based hairs. Ligule very short, covered with long hairs. Blade cordate at the base, linear-lanceolate, gradually acutate, more or less 3 cm. long, 5-7 mm. broad, flat, on both sides but especially on the upper sparingly covered with spreading bulbous-based hairs, margin thickened, distinctly undulate, fimbriate with long tubercular hairs. Racemes 2-3, distant from each other more or less 1 cm., 2 cm. long, stout, erect-patulous or finally reflexed ; rhachis subtrigonous, pilose at the base, more than twice as narrow as the spikelets slightly undulate, the angles scaberulous, otherwise glabrous, giving off solitary pedicels. Spikelets biseriate, broadly elliptic, very acute, 4 mm. long, anteriorly almost flat, posteriorly very convex, green, glabrous. Involucral glumes very unequal. Lower almost $\frac{1}{3}$ of the spikelet, subobtuse, 5-nerved, upper as long as the spikelet, very acute, distinctly 7-9-nerved. Lower floral glume equal in shape to the upper involucral glume, flat, 5-nerved, glabrous on the back, tubercular-echinulate near the margin, except near the tip and base, paleate. Upper floral glume shorter than the preceding glumes, elliptic with a rounded tip, rigid, opaque, brown-straw-coloured, rugulose, long caudate, 5-nerved, bullate below.

Locality : S. M. Country and N. Kanara (A. P. Young ex Henrard). We have not seen the specimen.

Distribution : So far endemic.

Note : Henrard has a variety from the same localities : var. *Velutina* which differs from the type by the densely pubescent spikelets. What we said in a note under the previous species can be applied here.

4. **Urochloa Helopus**, Stapf in Prain Fl. Trop. Afr. ix, 595 ; Haines in Bot. Bihar & Orissa 1002.—*U. pubescens*, Kunth Rev. Gram. i, 31, Enum. Pl. i, 74.—*U. panicoides*, Schult. Mant. ii, 595 (*non* Beauv.).—*Panicum Helopus*, Trin. in Spreng. Neue Entdeck. ii, 84 ; Panic. Gen. 150, *et* Gram. Ic. *et* Descr. ii, t. 183 ; Nees Agrost. Bras. 117 ; Steud. Syn. Pl. Glum. i, 57 ; Duthie List Grass. N. W. Ind. 4, Fodd. Grass. N. Ind. 8.—*P. Helopus* var. *glabrescens*, K. Schum. in Engl. Pfl. Ost.—Afr. C. 101 ; Stapf in Dyer Fl. Cap. vii, 392.—*P. hirsutum*, Koen. ex Roxb. Fl. Ind, i, 300.—*P. Kœnigii*, Spreng. Syst. i, 311.—*P. hochstetterianum*, A. Rich. Tent. Fl. Abyss. ii, 369.—*P. geminatum*, Hochst. ex A. Rich. l.c. (*non* Forsk.).—*P. controversum*, Steud. Syn. Pl.

Glum. i, 60; Schweinf. in Bull. Herb. Boiss. II, ii, 19.—*Setaria? hirsuta*, Kunth Rev. Gram. i, 47, Enum. Pl. i, 157.—*S pilifera*, Spreng. Syst. iv, Cur. Post. 33.—*Panicum javanicum*, Hook. f. in F.B.I. vii, 35 (*non* Poir, *partim*); Cke. ii, 933 (*partim*).

This is the species which was described by Hook. f. and many others, amongst them by Cooke, under the name of *Panicum javanicum*, Poir. According to Stapf *P. javanicum*, frequently confused with *U. Helopus*, is *U. panicoides*, Beauv., a distinct species. A number of synonyms and references have, according to the same authority, to be excluded from the F.B I. under *Panicum javanicum*: Bentham's Flora of Australia (vii, 476) mentions *Panicum Helopus*, but it is partly *Brachiaria notochtona*, Stapf (*Panicum notochtonum*, Domin) and partly *Brachiaria ramosa*, Stapf. T. 7 in Duthie's Fodd. Grass. does not represent *Panicum Helopus*, but *Brachiaria ramosa*, Stapf. *Urochloa panicoides*, Beauv. is a synonym of *Panicum javanicum*, Poir. *P. trichopus*, Hochst. is *Urochloa trichopus*, Stapf.

As a number of foreign elements have crept into the usual descriptions of our species we give Stapf's description of *P. Helopus*.

Annual. Stems tufted, 30–60 cm. high, erect or geniculately ascending from a short sometimes rooting base, frequently sparingly branched from the lower nodes, 4–10-noded, intermediate internodes like the uppermost (peduncle) very sparingly pubescent or almost glabrous. Leaf-blades lanceolate to linear-lanceolate from a wider and semi-amplexicaul base, 3·5–15 cm. by 8–12 mm. rarely up to 25 cm. and then linear and narrowed towards the base, soft, flat, pale or yellowish-green, loosely and often finely hirsute with tubercle-based hairs, rarely almost glabrous, margins usually crisped or wavy and more or less ciliate. Sheaths somewhat loose, pale, striate, densely ciliate upwards, more or less shortly hirsute with the hairs tubercle-based, nodes pubescent to subvillous. Ligules a densely ciliate rim. Inflorescence of mostly 4–7 erect or at length more or less spreading stiff or slightly flexuous sessile or subsessile spiciform secund racemes; common axis 1·2–5 (rarely 7·5 cm.) long, subsemiterete below, much flattened upwards, pubescent. Racemes moderately dense, 2-seriate, simple, 2·5–5 cm. long, solitary or here and there approximate and then unevenly distributed; rhachis straight or slightly wavy, flat on the back, about 1 mm. wide, villous at the base, glabrous upwards, rarely sparingly hairy, angles scabrid; internodes up to 1 mm. long; pedicels solitary, reduced to short stout stumps with discoid tips, frequently bearing some long spreading hairs. Spikelets laterally contiguous or subcontiguous ovate to elliptic-oblong, very acute, 4–5 mm. long, greenish, glabrous or pubescent. Involucral glumes dissimilar; lower broad-ovate, subobtuse to acute, clasping at the base, 1·5–2 mm. long, glabrous or sparingly and minutely pubescent, 5-nerved upper one corresponding in size and outline to the spikelet, prominently 7–11-(mostly 9-) nerved, glabrous or pubescent. Lower floral glume very similar to the upper involucral glume, but flat or slightly depressed, 5–7-nerved with the inner side-nerves distant, glabrous or pubescent, pale oblong, acute, slightly shorter than its glume. Anthers 2 mm. long. Upper floral glume rotundate-elliptic, greenish to pale brown, 2·5–3 mm. long, pale finely transversely rugose or granular, mucro up to 1 mm. long, sparingly barbellate. Grain rotundate-elliptic on outline, much compressed, about 2 mm. long, yellowish or greenish.

Locality: *Gujarat*: Baroda (Cooke *teste* Cooke).—*Deccan*: Katraj Ghat, 11 miles S. E. of Poona (Shevade!); Poona (Woodrow!); Deolali (Blatter A110!); Ganeshkhind Bot. Gardens (Patwardhan!); Chattarshinji (Bhide!); Mangiri, near Poona (Gammie 15344!); Akola (Mamlatdar of Akola!); Dapuri near Poona (Jacquemont 482!).—*S. M. Country*: Dharwar, elevation 2,500 ft., rainfall 35 inches (Sedgwick 2157!); Kilgerry (Talbot 2419!); Haveri (Talbot 2284!); Bijapur (Meebold 11201!); Badami (Woodrow *teste* Cooke).—*Kanara*: Kulgi, elevation 2,000 ft. (Talbot 2283!); Nundgod (Mamlatdar of Nundgod).

Distribution: Plains of India, Ceylon, tropical and S. Africa, Mauritius.

49. ECHINOCHLOA, Beauv. Agrost. 53, t. 11, fig. 2; Stapf in Prain Fl. Trop. Afr. ix, 604.

Annual or perennial. Leaf-blades from a slightly constricted or equally wide rarely much attenuated base. Ligules 0 or represented by a transverse fringe of hairs. Panicles of crowded or loosely arranged secund speciform branches mostly bearing spikelets from the base or near it. Spikelets ovate to elliptic- or lanceolate-oblong, usually cuspidate or awned, very convex on the back, flat or slightly depressed in front, falling entire from the pedicels, 2-nate or clustered, secund and abaxial on the triquetrous rhachis of racemosely arranged false spikes Involucral glumes unequal, membranous, the lower much shorter, more or less ovate from a clasping base, 3-5-nerved, often mucronate, the upper corresponding in length and outline to the spikelet (as seen from the back), very concave, 5-7-nerved, acute, cuspidulate or cuspidate, rarely produced into a short awn. Lower floret equalling the upper glume (excluding cusps or awns); lower floral glume very similar to the upper involucral glume, but flat or depressed on the back and often with a more pronounced cusp or an awn; pale equal to the body of the valve, or in barren florets more or less reduced, hyaline, finely 2-keeled. Upper floral glume ovate to elliptic-oblong, apiculate or obtuse, very convex on the back, subcoriaceous or crustaceous, polished, faintly 5-nerved, margins firm, involute up to near the tip, then flat, not embracing the tip of the pale, pale sub-equal to the glume and similar in substance, with rounded keels and flaps which thin out towards the flat slightly recurved tips. Lodicules 2, cuneate, fleshy. Stamens 3. Styles distinct; stigmas plumose, exserted from near the tips. Grain broad-elliptic dorsally flat, ventrally convex; hilum punctiform, subbasal.

Species about 20-25.—The warm regions of both hemispheres.

Note: It will be useful to remember what Stapf says regarding this genus l.c. 605: 'The segregation of the numerous forms which make up the genus *Echinochloa* and their reduction to more or less well definable species is still unsatisfactory, mainly owing to their apparently endless variability and the difficulty, if not impossibility, of discriminating between stable and unstable modifications and the effects of hybridization. Here, as in other cases, observation in the field and experiment will have to decide.'

Cooke describes under *Panicum* 2 species which have to be referred to *Echinochloa*: *P. colonum* and *P. stagninum*. We add *E. Crus-Galli* which Cooke thought did not occur anywhere in the Bombay Presidency.

I. Lower involucral glume and upper floral glume equally acute or cuspidate ... 1. *E. colona.*
II. Lower involucral glume and upper floral glume cuspidate or produced into an awn, the latter more than the former.
  1. Ligule 0 ... ... 2. *E. Crus-Galli.*
  2. Ligule a fringe of stiff hairs or absent in the uppermost leaves ... ... 3. *E. stagnina.*

1. **Echinochloa colona**, Link Hort. Berol. ii, 209; Parl. Pl. Nov. 40; Hitchc. in Gray Man. Bot. ed. 7, 118. *et* in Contrib. U. S. Nat. Herb. xii, 213, xvii, 256, xviii, 345; Stapf in Prain Fl. Trop. Afr. ix, 607; Haines in Bot. Bihar & Orissa 997.—*E. zonalis*, Parl. Pl. Panorm. i, 119.—*Panicum colonum*, Linn. Syst. Veg. ed. 10 (1759), 870, Sp. Pl. ed. ii, 84; Jacq. Eclog. Gram. t. 32; Roxb. Fl. Ind, i, 299; Nees Agrost. Bras. 119; Steud Syn. Pl. Glum. i, 46; Benth. Fl. Hongk. 411, *et* Fl. Austral. vii, 478; Griseb. Fl. Brit. W. Ind. 545; Baker Fl. Maurit, 438; Duthie List Grass, N. W. Ind. 3, Indig. Fodd. Grass. t. 4, Fodd. Grass. N. Ind. 4; Boiss. Fl. Or. v 435; Balf. f. Bot. Socotra 310; Hack. in Bol. Soc. Brot. vi, 140; Schweinf. in Bull. Herb. Boiss. ii, App. ii, 20, 95; Hook. f. in F.B.I. vii, 32; Cke. ii, 931.—*P. arabicum*, Nees ex Steud. Nomencl. ed. ii, 252, *et* Syn. Pl. Glum. i, 63 (*partim*).—*P. brizoides*, Linn. Mant. ii, 184.—*P. tetrastichon*, Forsk. Fl. Aegypt.—Arab. 19.—*P. cuspidatum*, Roxb. Fl. Ind. i, 301; Duthie Grass. N. W. Ind. 3; Steud. l. c. 47.—*P. pseudocolonum*, Roth. Nov. Sp. 47; Steud. l.c. 46.—*P. zonale*, Guss. Ind. Sem. H.R. Bocc. 1825, *et* Fl. Sic. Prodr. i, 82.—*P. numidianum*, Presl. Cyp. & Gram. Sic. 19 (*non* Lam.).—*P. Daltoni*, Parl. ex Webb in Hooker Niger Fl. 185.—*P. equitans*, Hochst. ex A. Rich. Tent. Fl. Abyss. ii, 365.—*P. Crus-Galli* var. *colonus*, Coss. Glum. Expl. Alger. 28.—*P. Petiveri*, Kotsch. ex Griseb. l.c. (*non* Trin.).

Description: Cke. ii, 931.

Locality: *Sind*: Karachi (Nankad!); Mirpurkhas (Bhide!, Sabnis B1176!); Sind (Blatter!); Larkana, barren plains (Sabnis B93!, B95!, B457!); Sanghar (Sabnis B899!, B894!); Nasarpur, clayey soil (Sabnis B1048!); Mirva Canal, Khairpur Mirs (Sabnis B263!); Khairpur Mirs (Sabnis B337!); Sehwan to

Laki (Sabnis B63 !) ; Hyderabad (Sabnis B49 !) ; Pad-Idan (Sabnis B516 !) ; Chuar Ch. (Blatter & McCann D616 !, D621 !) ; Baghar (Blatter & McCann D617 !) ; Mirpur Sakro (Blatter & McCann D618 !, D620 !) ; Ghulamalla (Blatter & McCann D619) ; Shikarpur (Woodrow).—*Gujarat* : Lasundra (Chibber !) ; Anjor (Cutch), brackish water (Blatter 3743 !) ; Ahmedabad (Cowper !) ; Morvi, Kathiawar (Woodrow).—*Khandesh* : Muravad, Tapti bank (Blatter & Hallberg 4435 !) ; Bor, Tapti Island (Blatter & Hallberg 4439 !); Dadgaum (McCann A104 !) ; N. slope of Chanseli (McCann A105 !).— *Konkan :* Bombay, salt swamps (Woodrow !) ; Vetora (Sabnis 33589 !) ; Charni Road, Bombay (Sabnis 4292!) ; Bombay, very common (McCann!); Alibag, rice fields (Ezekiel!).— *Deccan :* Purandhar Fort (Bhide !, McCann 5520 !); Nira Canal, Poona District (Chibber !); Khandala, very common (McCann A101 !); Sholapur (D'Almeida A102!); Igatpuri (Blatter & Hallberg 5487 ! ; McCann 4331!); Deolali (Blatter A103!); Poona, canal (Ezekiel !).—*S. M. Country* : Dharwar (Sedgwick 2655!) ; Castle Rock (McCann A106!); Londa (Woodrow).—*Kanara* : Dongi Nallah (Talbot !); Karwar (Talbot 614!).

Distribution : Throughout the plains of India, Ceylon, all over the tropics and the warm-temperate regions of the world. Probably of African and Indian origin according to Stapf.

The same author is of opinion that *Panicum frumentaceum*, Roxb. which is grown in India as a grain crop, is evidently descended from *Echinochloa colona*. Roxburgh's species may, therefore, be treated as a variety :

var. frumentacea, Blatter & McCann.—*Echinochloa frumentacea*, Link. Hort. Berol. i, 204 ; Aitchis. Cat. Panjab Pl. 161.—*Panicum frumentaceum*, Roxb. Fl. Ind. i, 304 ; Schult. Mant ii, 230 ; Trin. Sp. Gram. Ic. t. 164 ; Duthie Grass. N. W Ind. 4, Field & Gard. Crops 3. t. 24, Fodd. Grass. N. Ind. 8.—*P. Crus-Galli*, var. *frumentaceum*, Trim. Cat. Ceyl. Pl. (1885), 104.—*Echinochloa Crus-Galli*, var. *frumentacea*, Haines in Bot. Bihar & Orissa 998.—*Panicum stagninum*, Retz. var. *frumentacea*, Cooke in Cke. ii, 931.—*Oplismenus frumentaceus*, Kunth Rev. Gram. i, 45, Enum. Pl. i, 146 ; Dalz. & Gibs. Bomb. Fl. Suppl. 98.

Description : Tall, robust. Stems erect, from 60 to 120 cm. high. Panicle often nodding. Spikes secund, incurved, crowded. Spikelets mostly 3-nate, unequally pedicelled, one at least sessile, varying from hispidulous to almost glabrous, and from acute to cuspidulate or rarely distinctly cuspidate.

Locality : Cultivated in and near the Ghat districts.

2. **Echinochloa Crus-Galli,** P. Beauv. Agrost. 161 ; T. Nees Gen. Fl. Germ. Monocot. i, t. 21 ; Reichenb. Ic. Fl. Germ. i, t. 29, fig. 1411, 1412 ; Hitchc. in Contr. U.S. Nat. Herb. xii, 213 ; Stapf in Prain Fl. Trop. Afr. ix, 610 ; Haines in Bot. Bihar & Orissa, 998.—*E. commutata*, Schult. Mant. ii, 267.—*E. hispidula*, Nees in Royle Ill. Bot. Himal. 416 ; Dalz. & Gibs. Fl. Bomb. Suppl. 98.—*Panicum Crus-Galli*, Linn. Sp. Pl. ed. i, 56 ; Fl. Dan. t. 1564 ; Host. Gram. Austr. ii, 15, t. 19 ; Knapp Gram. Brit. xi, Trin. Sp. Gram. Ic. t. 161, 162 ; Nees Fl. Afr. Austr. 58 ; Steud. Syn. Pl. Glum. i, 47 ; Benth. Fl. Austr. vii, 479 (*partim*) ; Duthie List. Grass. N.W. Ind. 3 (*partim*) t. A. fig. 1; Boiss. Fl. Or. v, 435 ; Hook. f. in F.B.I. vii, 30 (*partim*) ; Stapf in Dyer Fl. Cap. vii, 397.—*P. hispidum*, Forst. Prodr. 7 ; Nees Agrost. Bras. 257.—*P. hispidulum*, Retz. Obs. v, 18 ; Lam. Ill. i, 171 ; Roxb. Fl. Ind. i, 306 ; Nees Fl. Afr. Austr. 57 ; Royle l. c. 420 ; Steud. Syn. Pl. Glum. i, 47.—*P. oryzinum*, Gmel. Syst. i, 157.—*P. stagninum* Host. Gram. Austr. iii, t. 51 (*non* Retz.).—*P. Hostii*, Marsch. Bieberst. Fl. Tauro-Cauc. iii, 57.—*P. limosum*, Presl ex Nees Agrost. Bras. 257.—*Milium Crus-Galli*, Moench Meth. 202.—*Oplismenus Crus-Galli*, Dumort. Agrost. Belg. ; Kunth Rev. Gram. i, 44, *et* Enum. i, 143 (*excl. syn. P. zonale*).—*O. limosus*, Presl., Rel. Haenk. i, 321 : Kunth Enum. i, 144.—*Orthopogon Crus-Galli*, Spreng. Syst. i, 307.—*O. Retzii*, Spreng. l.c.

Description : Annual, up to 1 m. high. Stems geniculately ascending, branched below, compressed towards the base, glabrous and smooth, internodes enclosed or exserted. Leaf-blades linear, base scarcely narrowed, narrowed to an acute point, 7–25 cm. by 6- over 12 mm., flat, subflaccid, glabrous, more or less dull greyish-green, smooth or scaberulous below, particularly towards the tip, margins finely cartilaginous, scabrid to almost smooth. Sheaths somewhat loose, the lower often compressed, whitish and thin, the upper subherbaceous, all smooth, glabrous and striate except the basal which are pubescent above their insertion. Ligules 0, junction of blade and sheath glabrous inside marked by a brown zone. Panicles erect, strict or flexuous, at length exserted, 7·5–20 cm. long; axis triquetrous, scabrid; branches few to about 15, solitary or 2-nate, suberect or spreading, distant except the uppermost or all more or less approximate forming a 'lobed' panicle, the lower 2·5–6·2 cm. long, forming rather stout dense mostly many-ranked simple or subcomposite subsecund sessile false spikes; rhachis triquetrous, scabrid, coarsely bristly, particularly near the nodes; pedicels fascicled or 2-nate, very short, up to 1 mm. long, scabrid, bristly at the base, tips subdiscoid. Spikelets crowded, ovate-elliptic in outline, acute, cuspidate or awned 2·5–3 mm. long, greenish or tinged with purple. Lower involucral glume membranous, very broadly ovate, clasping at the base, obtuse to subcuspidate, 1 mm. long, 5-nerved scaberulous; upper herbaceous-membranous, very broadly ovate-oblong, concave, acute, cuspidate, as long as the spikelet, 5- or (near the tip) 7-nerved, rigidly pubescent between the scabrid and spinulose nerves. Lower floral glume similar to the upper involucral glume, but flat or depressed on the back, cuspidate or produced into a scabrid often long flexuous awn, 7-nerved (at least at the tip), pale elliptic, shorter by ¼ than its glume, keels scaberulous upwards; upper floret hermaphrodite, elliptic-ovate in outline, cuspidate, over 2 mm. long, whitish or yellowish, polished, glume and pale subcoriaceous. Anthers oblong. Grain broad-elliptic in outline, 1·5 mm. long.

Locality: *Sind*: Mirpurkhas (Bhide!); Ghulamalla (Blatter & McCann D613!); Keti (Blatter & McCann D614!).—*Gujarat*: Stream near Prantij (Sedgwick!); the Bokh, Prantij Taluka (Sedgwick 1144!).—*Deccan*: Poona (Woodrow!).—*S. M. Country*: Aluarar, elevation 2,000 ft., rainfall 35 inches (Sedgwick 3096!); Bidi, elevation 2,500 ft., rainfall 50 inches (Sedgwick 3076!).—*Kanara*: Halyal (Talbot 2167!).

Distribution: Common through the greater part of India and Malaya; as a weed throughout the warm temperate countries of the northern hemisphere, rather rare in the tropics of Africa and the New World and south of the Tropic of Capricorn (Stapf).

Uses: See Duthie, Fodd. Grass. N. Ind. 6; Vasey Agric. Grass. Unit. States ed. ii, 27; Maiden Man. Grass. N. S. Wales, 38–41; Yearbook U. S. Dept. Agric. (1902), 580–582.

3. **Echinochloa stagnina**, P. Beauv. Agrost. 161; Stapf in Prain Fl. Trop. Afr. 617.—*E. scabra*, Roem. & Schult. Syst. ii, 479.—*Panicum stagninum*, Retz. Obs. v, 17; Roxb. Fl. Ind. i, 295; Grah. Catal. 237; Nees Agrost. Bras. 261; Trin. Pan. Gen. 128, *et* in Mém. Acad. Pétersb. 6me sér. iii, 216; Steud. Syn. Pl. Glum. i, 47; Stapf in Dyer Fl. Cap. vii, 394; Cke. ii, 930.—*P. scabrum*, Lam. Ill. i, 171, *et* Encycl. iv. 744; Nees l. c.; Steud. l. c.—*P. Galli*, Thunb. Prodr. 18, *et* Fl. Cap. ed. i, 389, ed. Schult. 103.—*P. Crus-Galli*, Woodrow in Journ. Bomb. Nat. Hist. Soc. xiii (1901), 433 (*non* Linn.).—*P. Crus-Galli*, var. *stagninum*, Fenzl. in Ind. Sem. Hort. Berol. 1850; Hook. f. in Trim. Fl. Ceyl v, 136; Prain Beng. Pl. 1174.—*P. Crus-Galli*, vars *maximum*, *submuticum et leiostachyum*, Franch. Contr. Fl. Congo Franc. in Bull. Soc. Hist. Nat. Autun. viii, 347.—*P. pictum*, Nees Fl. Afr. Austr. 59 (*non* Agrost Bras.).—*P. Burgu*, A. Cheval. in Rev. Cult. Colon. vii, 513–520.—*P. Lelievrei*, A. Cheval. l.c. 516.—*P. oryzetorum*, A. Cheval. l.c.—*Orthopogon stagninus*, Spreng. Syst. i, 307.—*Oplismenus stagninus*, Kunth Rev. Gram. i, 44, *et* Enum. i, 144 (*partim*); Dalz. & Gibs. Fl. Bomb. 292.—*O. scaber*, Kunth Rev. Gram l.c. 44, Enum. l.c. 145.

Description: Cke. ii, 930, under *Panicum stagninum*.

Locality: *Sind*: Ghulamalla (Blatter & McCann D615!).—*Konkan*: Virar, on bank of a tank (McCann 9585!, 9584!).—*Deccan*: Igatpuri (Blatter & Hallberg 5473!); Khandala, in water in the smaller village tank (McCann 27441!); Panchgani (Blatter & Hallberg B1241!).—*S. M. Country*: Hulkop, elevation 2,000 ft., rainfall 50 inches (Sedgwick 3175!); Chikkerur, Taluka Kod, water hole by road (Sedgwick 1969!); Bomigatti tank (Sedgwick 3830!); common in the Carnatic (Sedgwick).—*Kanara*: Pardhani (Talbot 3136!).

Distribution: More or less throughout India, Ceylon, tropical and S. Africa.

Uses: Considering tropical African conditions Stapf observes (l.c. 619): 'This grass deserves every attention on account of its locally abundant supply and high sugar-content. Chevalier states that it is the most useful of all the plants growing in a wild state in the neighbourhood of Timbuctu. Every part of it is utilized. It yields excellent fodder, material for thatching and caulking, is burned to produce a salt used in the manufacture of soap and indigo, the grains are eaten and the canes are gathered for extracting sugar or preparing vinaigre or a beverage resembling cider. Sir John Kirk also describes it as one of the richest of fodder grasses. Although typically a perennial with long rhizomes creeping in the mud of swamps, lakes and rivers, it seems on temporarily flooded land to flower frequently the first year and then to behave as an annual.'

(*To be continued*).

A COLLECTING TRIP TO LADAK

BY

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Assistant Curator, Bombay Natural History Society

Part II

(*With two Plates*)

(*Continued from page 517 of this Volume*)

Shushal (14,500 feet) our next halt, is a delightful spot. We had camped in a willow garden, with the ever-present 'Gompa' (monastery) perched on a hillock. We were 'pleasantly' surprised to find next morning, that a heavy fall of snow had blotted out the landscape, which was not usual for the time of the year at those altitudes, unless something was radically wrong somewhere.

Half a mile behind our camp, the Bar-headed Geese (*Anser indicus*) were breeding on a shallow 'jheel' and appeared to lay their eggs on little grass-topped islands. On our arrival there were quantities of egg-shells scattered about and only one young in down, which was secured.

It is probable that the young are preyed upon by birds of prey. The Tibetan, for a certainty will not molest these birds, believing that with the hatching out of successful broods, the year's harvest is as good as assured. They even go so far as to appoint a 'watchman', who does not seem very enthusiastic over a job that keeps him out all day, and will no doubt give any naturalist the necessary help, for a consideration, and be glad to see the last of the 'darned things'.

A suitable tip in the right quarter often got us much invaluable information on the breeding sites of Owls, Partridges and Snowcocks, though some of the local sportsmen drew on their imagination freely and appeared quite content merely with having strolled out with a Sahib. Others again seemed overjoyed with the prospect of a morning with the guns and felt quite hurt if their lively chatter was cut into by the interpreter, with the remark 'that they should keep their reminiscences for their great-grandchildren on long winter nights'.

The Large Eagle Owl breeds among bare rocky hills, usually on the precipitous sides, in huge 'rifts'. At Shushal we secured a parent bird with two young in down. The Brahminy was also seen leaving the hillside, and in among the reeds the Mallard had changed the plumage by which we know him so well, for one quite insignificant.

Brandt's Snow Finch (*M. brandti hæmatopyga*) appeared in large flocks and as Col. Meinertzhagen observed, these were all females. The males seemed to keep to the higher altitudes, and even as late as June neither sex showed any signs of genital development.

Among the Rose Finches, *Erythrina rubicilla severtzovi* appeared the commonest along the Pangkong Lake, frequenting the most desolate regions.

Another species of Rose Finch, which roosted in hundreds on the willow trees around our camp, has been identified as a new race. Col. Meinertzhagen has named this *Erythrina rubicilloides lapersonnei* and gives the following :—

'Ladak specimens are generally paler above and below, the upper parts not washed with such a deep crimson and the under parts of a paler and more delicate rose-colour than occurs among Kansu specimens. Females are also generally paler.

'A single female was obtained at Leh on May 7 and they occurred in large numbers at Shushal in June, where many hundreds used to roost in a willow grove in which I was camped. Birds seen at Chumathang at 13,050 feet above Leh on the Indus were also believed to be of this species. They are not so shy as *E. r. severtzovi* and seem to prefer a less desolate type of country. They were busy building at Shushal in June, many incomplete nests being found in willow-trees and furze (*Caragana*) from one to twelve feet from the ground.

'Birds recorded under *Erythrina rhodochlamys* by Hume and Henderson ("Lahore to Yarkand," p. 259) and by Sharpe (Second Yarkand Mission, p. 42), are without doubt *E. rubicilloides lapersonnei.* The birds observed by Henderson at Tutyalak (13,000 feet) and recorded as *severtzovi* were more likly to be *Pyrrhospiza*, which is common there. It is not suitable country for *Erythrina rubicilla* or *rubicilloides.*'

Leaving Shushal on the 22nd June we cut across to the Indus over a mountainous pile of rocks, which leaves one with the impression that this particular part of the globe has been left unfinished by the Great Architect and the material strewn about.

We follow the hot dantesque gorges of the Indus as they wind in and out amidst the silent rocky mountains whose peaks cut a jagged line against an azure sky. Flat-topped hamlets punctuate the monotony of sun-baked rock and muddy water where the gorges open out; but such openings are few. The general aspect is that of the protracted neck of a bottle, so narrow in places, that it would not be a feat to kick one's hat across.

While on the theme, a brief hydrographical account of the upper reaches of the Indus which of recent years, political movements have made accessible, would not bore the reader more than we have done already.

The remarkable phenomena of the upper reaches of the Indus Valley are the clearness and transparency of the atmosphere and the great difference between the sun's temperature *in vacuo* and the air temperature in the shade. This difference as recorded at Leh occasionally exceeds 90°.

The sources of the Indus have been traced to the glaciers of the Kailas group of peaks and except for the remarkable instance of transverse drainage, pursues an even north-westerly course amidst an array of mountain scenery which for its majesty of sheer altitude is unmatched by any in the world.

At Leh the river has already pursued an even course of 300 miles from its source and except for the divergence which occurs about 100 miles above Leh, continues on a comparatively gentle placid course over its sandy bed, when it captures the Shyok River (a tributary almost as large as itself) and fed by the monster glaciers of the Kara-Koram Range. The combined streams still hold on a north-westerly trend for another 100 miles deep hidden under the shadows of the vast array of snow-capped mountains of Baltistan until they arrive a few miles below Gilgit. Here the great change of direction to the south-west occurs, which is thereafter maintained till the Indus reaches the ocean.

The Indus of to-day is the Indus of myth and legend but swept clean of mystery and the hidden strongholds of the fanatics along its banks—a hindrance from all time to the progress of this world.

Many important points are bridged by the suspension system, though there still exists the 'Cantilever' and the rope-bridge which sways uneasily over the roaring waters.

We dipped into Puga in Rupshu and continued up the sandy valley to the shores of the Polokonka Lake (14,000′), where we found the Great Crested Grebe (*Podiceps cristatus cristatus*) breeding, as well as a large colony of Brown-headed Gulls in an advanced stage of genital development.

The eggs of the Crested Grebe are placed on a floating mass of reeds and the eggs, 4 to 6, in number appear to take on the colour of the decaying matter in the nest.

Several lakes in the east districts at 14,000 feet above sea level have been of much greater extent and connected to the drainage system of the country, but they are now mostly without outlet, saline, and in process of desiccation.

The highest visible water mark of the Polokoncha Lake is quite 150 feet above its present level, and recent years seem to show a much more rapid process towards drying.

We shifted camp to the northern end of the lake and pitched our tents on the lawn-like banks of a mountain torrent, while all around the Poppies and Primulas grew in wild profusion.

There was comparatively little of bird or animal life. Guldenstadt's Redstart (*Phœnicurus erythrogastra grandis*) seemed in sole possession of the stream. The surrounding hills offered nothing but bareness and desolation.

Small parties of Wild Asses, or Kiangs as they are more commonly known, visited the shores of the lake in the early mornings and late evenings, the dead stillness being occasionally broken by their 'shrieking bray.' There seems a good bit of discrepancy between the accounts of the Kiang's cry given by different sportsmen. We could safely leave it as intermediate between the neigh of a horse and the bray of an ass—almost alike to the vocal efforts of a mule, which at its very best sounds like nothing on earth.

Whether in the rarified atmosphere the Kiang is as fleet of foot as the species from Sind, it is difficult to say. The former can 'move' on occasions taking 18,000 and 19,000 feet hills in grand style.

Besides its dreariness, the shores of the Polokoncha hold for the

THE ROCKY ROAD TO YARKAND

OUR CAMP AT 15,500 FT. IN THE KARAKORAM

traveller a certain sadness. It was here that the wife of a young Englishman met a tragic end, by inadvertently lighting a fire in her tent with the very obvious result, when the very first rule in camping is broken.

On the 28th June we left the Polokoncha Lake and crossing the Taklung Pass (17,600 feet) which rises sheer from the shores of the lake, descended rather abruptly into the Gya Gorge.

While on the Taklung Pass the writer brought off a record bag of Snow-cock (*Tetraogallus tibetanus*) obtaining six birds in a single shot! The possibility of such a feat may be enhanced when it is known that two adult birds had their heads together, while four young squatted on the mother bird's back.

Following the Gya Gorge, which with rare determination pierces an arm of the Ladak range, we swing off to right angles and enter once again the Indus Valley which still keeps its boulder-strewn nature. You wonder if the track lost itself or from fright and loneliness ran up a frightfully untidy glen to Hemis, or that Hemis huddled itself among the bare rocky crags in trying to escape from the encroachments of 'western civilization', for even here the missionary offers a very very old dog a new collar, expecting him to do new tricks.

We wind up the frightfully untidy glen into the heart of the mountains, where amid forbidding rocky hills, Hemis, the Mecca of one of the noblest of religious faiths and simple philosophies yet unfolded by man, stands gaunt and silent.

True to this land of contradictions and surprises, a delightful garden of stately poplars and wild roses, whose delicate perfume scented the balmy air, was cradled among the barren hills and set like a first-water jewel in a cheap trinket. A multi-coloured crowd of Ladakis thronged the massive gates that led into the monastery; while taking his joys less seriously, that hardy son of desolate wind-swept steppes, the Tibetan, could easily be picked out by his easy swinging walk and his fine example of full-blooded manhood. From the babble of voices it seemed that all Ladak and his wife had turned up to witness the annual Devil-dancing and Festival held at Hemis. And so the sun set on this strange scene, casting grotesque figures among the crags, until night shrouded the narrow glen in a sombre mantle, the darkness punctuated with innumerable camp fires.

It might have been a scene from the Arabian Nights, if such a scene did not date back to 500 B.C., for Hemis is almost as old as the hills, even older some say.

The religious displays or 'Devil-dances' enacted annually among the Bhuddists are familiar sights anywhere between Ladak and Bhutan.

Much has been written on the various conceptions of this mystic religion. Mystic, perhaps from the theologist point of view but to the weary traveller it appears a bewildering agglomeration of superstitions pieced together into an amazing farce, in which the 'Sons of Belial have a glorious time'.

Still one is really impressed by the rhythmic dancing, the gorgeous dresses and the grotesque masks worn by the dancers, which vie with each other in diabolic hideousness. Then, too, there is the perfect symphony produced by the treble and bass trumpets. The latter are ten feet in length and emit a volume of sound not unlike the amplified drone of a giant beetle in flight.

We left Hemis and arrived at Leh, by two easy stages on July 5th. As yet the status of many of the migrants had not been cleared up and the few days spent at Leh in preparations for our journey to the Karakoram were helpful in clearing up one or two problems. The Blue-throats (*Luscinia svecica* ssp.) which seem fairly well distributed along the Indus and Shyok Rivers, wherever suitable country is found, have for a considerable time confused naturalists by their variable colourings on the throat.

Thanks to Col. Meinertzhagen's systematic methods of collecting, we obtained a remarkable fine series ot the Blue-throat which breeds in Ladak. This has been identified as *Luscinia svecica abbotti*, and is characterized by a variable colouring of red, sometimes reddish-white and white stars. Among our specimens of *Luscinia suecica abbotti* there were five males and one female with pure white stars, four males with pure red stars and four males and two females a mixed red and white.

A red 'starred' male would have a white 'starred' female or *vice versa.* The type is a white-starred bird, and is known as the 'White-spotted Blue-throat.'

Next we have *Luscinia suecica pallidogularis* (the Red-spotted Blue-throat) which oftener than not is mistaken for the preceding bird. Of *pallidogularis* Col. Meinertzhagen says, 'Whereas in *abbotti* the "star" is very variable, in this race it is always pure red, sometimes a few white feathers are apparent. Underparts paler than in *abbotti* and with seldom much black at the lower end of the blue chest. Blue much paler. This is the only Blue-throat met with in Kashmir in spring. First arrivals (all males) were noted on March 23. This race does not breed (nor does any Blue-throat) in the Vale of Kashmir, though in Northern Kashmir, on the Gilgit Road at 11,300 feet I found two pairs feeding young. The adults are typical of this race.'

Thus we have *Luscinia (Cyanosylvia) suecica abbotti* breeding throughout the Indus and Nubra Valleys—but not in Baltistan; and *L. s. pallidogularis* breeding in Baltistan (Western Turkestan to East Trans-caspia—Hartert).

These observations are clear enough and backed with specimens, and should eliminate the difficulty in identifying the Blue-throats.

With the advent of spring the dreariness of winter seems never to have existed. It is a country of sunshine and rivers and rich fertile valleys; and far away the great mountains hang in the serene sky, peaks, crests, and ridges of inaccessible and eternal snow.

The little hamlets in the sweep of the Indus Valley peep through a smothering foliage of poplar and willow; while the cheerful chatter of the House Sparrows adds liveliness to the drowsy air.

It is surprising that the Jackdaw (*Corvus monedula sœmmeringii*), so abundant in the Vale of Kashmir, should not find its way up here (Leh). Beyond a couple seen in Leh in May we never came across these birds anywhere in Ladak. Surely there is some mistake in Baker's statement [1] that these birds breed in Ladak !

Nor does the Jungle Crow (*Corvus coronoides intermedius*) extend for any great distance into Ladak, though this bird has been recorded as breeding in Ladak. What may have been mistaken for the preceding bird is the Carrion Crow (*Corvus corone orientalis*), which we found quite plentiful at Kargil in April and took several clutches of eggs from nests in willow trees at Moulbeck (11,000 ft).

Elsewhere I have mentioned the House Crow (*C. s. zugmeyeri*) as occurring in the Vale of Kashmir, and then only being isolated to a few colonies, which Osmaston observes do not leave the valley but brave the winter. Perhaps it may yet be discovered that the Sind House Crow and the one in Kashmir may not belong to the same race.

If there is a paradox among birds it is the scavenger of Ladak—the Tibetan Raven (*Corvus corax tibetanus*). To see him studiously peer into the bowels of a dead horse or walk gingerly in the refuse of a village is to heartily dislike the fellow ; but to see him at ' play ' is truly amazing. They wanton about in a thousand different manners and postures, sometimes pursuing each other, and making a mock fight ; sometimes rising ; sometimes falling with closed wings ; sometimes floating a while in the air on their backs ; sometimes flying edgewise ; sometimes whirling round the monastery with vast rapidity ; and all with an eagerness and joyousness of motions and cries and screams that showed the overflowings of happy sensations too plainly to be mistaken. Besides these attractions, *C. c. tibetanus* has a ' most peculiar and extraordinary metallic call wondrously like the tones of bells which emitted from a hill-top has the resemblance to " vesper bells " heard at a distance.'

He also possesses a sense of humour. Observe his comical imitations of an eagle missing its prey. He will sit calmly by and watch the fruitless efforts of an eagle or buzzard, and then with twirls and turns and screams will show you how it shouldn't be done. But we digress. Our preparations are almost complete for the trip to the Karakoram. A slight change has occurred in our *dramatis personæ*. The shikari's abhorrence for the cook and his ancestors finds a head and he gives vent to his pent-up feelings. Feelings which, he confides in me, he has fostered ever since he clapped eyes on the son of Sheitan. And, like all true Muslims who at least a dozen times a day ' seek refuge in Allah from Sheitan the stoned ', he had no alternative but to resign.

Unfortunately this '*bataillerovale*' took place on a plateau at 16,600 feet, where the only Tibetan Grouse (*Syrrhaptes tibetanus*) we had seen, was secured. Our skinning after the day's march prevented either of us from a thorough search for more specimens. The incident will prove the effects of high altitude on the equanimity of the mind, of even those of little or no imagination.

The vacancy was soon filled up by a Yarkandi—a fellow who could go over a pass without a sob and be game for some more ! His is the type one meets along a line drawn from Yarkand, through Afghanistan and Baluchistan, along the highlands of Persia, into Kurdistan and so to Turkey ; and like the soldier of that country, he will fight or freeze, march and starve not only without a mutiny but even without a sense of grievance against anybody. He is a gentleman, and anyone acquainted with Muslim countries knows that a Moslem gentleman is unsurpassed in any country.

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[1] F. B. I. vol. i, page 36.

We left Leh on July 12, and camped that evening just below the Kardong Pass at 15,000 feet. Next morning a diligent search was made for that beautiful Rose finch (*Pyrrospiza punicea humii*) of which Col. Meinertzhagen secured one the evening we arrived. I had marched up a side valley to the foot of a glacier and drawn a blank and then up a rugged hill to about 16,000 feet, where, pausing from the effects of an oppressive atmosphere I looked back to where Leh lay basking in the noonday sun, and then for no apparent reason an unmitigated slab of dreariness came over me and I wished Leh, Ladak, the snowy mountains and all naturalists in the nether regions. High altitude again! If such feelings are allowed to run riot anything may happen ; but I had an employer who understood better than I then thought and shall always feel grateful to him for his tolerant attitude towards my misgivings. It is but human nature that we consider our own experiences in travel and adventure as unique (with special stress on the hardships), and completely ignore the fact that others have been before us and others will follow.

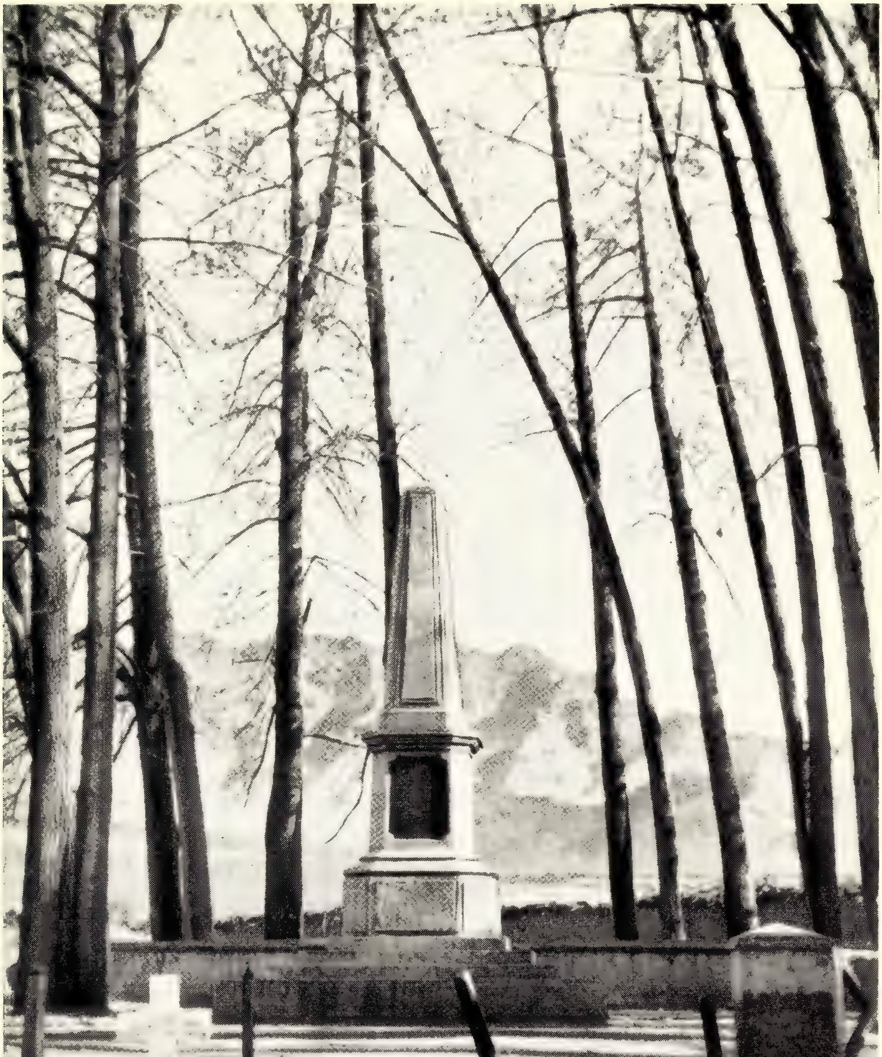
If you have crossed the Great Himalayas in winter and wandered through barren Ladak ; if you have crossed the Changla Pass at 18,500 feet and found another pass still higher, and your goal is a desolate region which is called Chang-chen-mo ;—if these trifling hardships damp your enthusiasm there is a quiet garden in Leh among the tall silent poplars, with the wild roses rambling over the swelling sod, that marks the trend of those pioneers who have ' gone before ;' it will make you ' gird up your loins ' for yet another try.

Here among the lone graves, an obelisk is raised by a thankful Government as a small mark of its appreciation to the memory of Ferdinand Stoliczka, that brilliant young scientist who gave of his best in that bloodless field of Natural History.

' Ferdinand Stoliczka,' so the inscription runs, ' the eminent young Geologist and Natural Historian accompanied the second Yarkand Mission in 1873 under Sir Douglas Forsyth. His health, severely affected by his previous work, gave way under the strain of strenuous work, he died at Shyok, in June 1874, ' while returning loaded with the spoils and notes of nearly a year's research in the least known parts of Central Asia.'

'The scientific results of this research,' writes Allen Hume, ' constitute an imperfect record of one single year's work of our dear friend and comrade Ferdinand Stoliczka. Imperfect,—because we had only his collections and a very brief diary—a mere *aide memoire* to work upon and so are able to present only the dry bones, as it were, of the results of his labours ; which had he survived to deal with them himself, would have risen up a living entity, vivified by his genius.

Imperfect,—but yet the best memorial that, under the circum-



Stoliczka's Tomb, Leh.

stances, we survivors could raise to him, untimely hidden in that lone Tibetan grave.

Imperfect,—but for all that, affording every here and there glimpses of the perseverance and self-devotion which, informed by wide scientific knowledge, and sanctified by a pure and generous heart, constituted Stoliczka's irresistible claims to respect the admiration and the love of all who ever came closely in contact with him.'

To those who are acquainted with the Palaearctic, that cruel relentless region, Stoliczka's name shall go down as one of those heroes whose bloodless blameless triumphs remain for ever the inheritance and the blessing of mankind.

The road after crossing the Kardong Pass at 17,600 feet descends abruptly into the sandy valley of the Nubra River. So abrupt was the snow-covered descent that we expressed a wish we would never have to assault this particular pass again. Fruitless wish!

The Nubra Valley, unlike the Indus, is fairly well cultivated—its entire length being more or less planted with large gardens and the gaps filled up with tamarisk bushes.

Panamik, 10,400 feet is the last village below the Karakoram. From here the road turns into the Nubra Gorge and follows the roaring river along its precipitous banks till an altitude of 13,000 feet is reached and then takes one on to a meadow, surrounded by stupendous mountains, with gigantic glaciers between the peaks.

The Karakoram Range forms the great water divide which separates the Indus drainage from that of the Yarkand and other Chinese-Tibetan rivers.

It is buttressed by K^2 (Godwin-Austen) 28,650 feet at its convergence with the undulating elevated plateau of Yarkand. The accompanying photograph gives some idea of the mountainous regions and two enormous glaciers are clearly seen on either side of the conical hill.

The pass over this range is crossed over a ten-mile glacier at 19,000 feet and lets one into Yarkand.

The snow had melted, only the very highest peaks retained their winter mantle, and the glaciers sparkled in the bright sunshine, and as the ice thaws huge boulders clatter down. The pass itself winds up the debris brought down by the melting of snow and ice, and, taken all round is the most savage bit of primeval chaos in all the mountain ranges we encountered.

Perhaps our protracted stay at high altitudes had weakened us physically or perhaps this was our Pisgah, but after a 'trial' up the slippery moraine, Col. Meinertzhagen decided to turn back and we began the return journey as eagerly as horses heading for stables.

It was Col. Meinertzhagen's intention to work the Shyok Valley up to its junction with the Indus and crossing over thence to reach Skardu. But this project had to be abandoned owing to the floods in some of the rivers.

We will not weary the reader with a description of the return journey to Leh.

Let it suffice that as we confronted the steep ascent to the

Kardong Pass, nothing in the vocabulary could express my feelings. It was the first pass wherein I lay hold of a Yak's tail as a means of locomotion and was hauled, much against my will, at a pace which caused alarming palpitations.

Skardu, which will be found upon the map, is the capital of Baltistan (or Little Tibet as it is called), and rests amidst a fine array of rugged mountains with the Indus sweeping past in a great horseshoe bend. We arrived here on August 13 after a hot trip through the Indus Gorge, to find Skardu among one of the dirtiest towns in the Himalayas. The inhabitants, originally Bhuddists, are now extremely bad imitations of Moslems, and like all proselytes are heartily disliked by both sides. However, Baltistan amply repays a visit. Its bird-life will settle many a knotty problem, being a sort of half-way house between Kashmir and the desolate regions that lie beyond Baltistan.

Most of the migrants were undergoing their autumn moult prior to setting forth on their winter passage, during our visit.

Conspicuous among these was that familiar little fellow, the Kashmir Red-start (*Phœnicurus ochrurus phœnicuroides*), who seemed to be fairly well distributed throughout Ladak also. The Eastern Red-spotted Bluethroat (*Cyanosylvia suecica pallidogularis*) were busy feeding young, as were the Pied Chats (*Œnanthe picata*).

The Hoopoes (*Upupa epops*) were in fresh plumage and ready to take off. These are distributed throughout Ladak and are found always near villages. The regularity of their arrival from the plains to their breeding haunts in Ladak has fixed the date for the commencement of spring ploughing in that country.

Cholera had been raging on Skardu on our arrival and we were glad to get a move on. On August 19 we left Skardu for the Deosai Plateau by way of the Satpur Lake, which is cradled between two rugged hills, quite 5,000 feet above Skardu, and worried our way up to 11,500 feet when we sat down for tiffin.

Up to this stage Col. Meinertzhagen had shown no sign of the catastrophe which befell him. We had even secured a new subspecies of the Twite (*Acanthis flavirostris baltistanicus*), as distinct from *Acanthis flavirostris ladacensis*, which is also a new sub-species.

That same afternoon, while we camped at about 13,000 feet, Col. Meinertzhagen had an attack of cholera and to add to this misfortune a snow storm swept down the hill.

Next morning we crossed over at 14,000 feet and the Deosai Plateau stretched away from our feet to the lilac hills, over an even grassy meadow, strewn with flowers. It was a relief being able to see such an expanse of open country after months of confined valleys and dreadful gorges. To see the sun set without intervening mountains or the golden orb of the moon rise over the rim of the world.

Even though the cholera still gripped him, Col. Meinertzhagen kept the same cheerfulness and keen interest he had always shown.

The plateau for the most part was well stocked with higher altitude birds. The Horned Larks were abundant and Col. Meinertzhagen has separated these from *Otocoris alpestris longirostris* and named them *Octocris* (*Eremophila*) *alpestris deosai.* In the *Ibis* (1927, p. 402) he says: ' A series of nine birds were obtained on the Deosai Plateau at the end of August. They are mostly in full moult, only three birds having completed their wing moult, (wings of three 127-131, culmens of six males 18-20 m.)

These birds run as large as *longirostis* but are both darker and browner in fresh plumage. They have the white gap between the black of the throat and that of the cheeks.

Apparently confined to the Deosai plateau between 12,000 and 14,000 feet.'

The Robin Hedge-Sparrow (*Prunella rubeculoides*) which was commonly met with between 12,000 and 14,000 feet over the greater part of Ladak was abundant on the plateau, and several nests were seen with fresh eggs on July 8. Col. Meinertzhagen has separated this form under *P. r. muraria.* We crossed the plateau in three marching days; owing to Col. Meinertzhagen's condition matters had to be rushed a bit and on August 27 we descended to Burzil Chowki on the Gilgit Road. We put in four days here and with Col. Meinertzhagen on his feet again, commenced the final stages to the Vale of Kashmir.

It was a late autumn evening when we crossed the Razdhanangan Pass and looked down on a sea of gardens and fields, and, sparkling through the gathering mists, the gem-like lakes that make the Vale of Kashmir ' a paradise on earth. '

(*The end*)

THE LANGURS, OR LEAF MONKEYS, OF BRITISH INDIA

BY

R. I. POCOCK, F. R. S.

Part II

(*With two plates and three text-figures.*)

(*Continued from page 504 of Vol. XXXII*)

II. The PYRRHUS-group.[1]

Distinguishable from the Entellus-group by the uniform golden-red hue which in the newly-born young pervades the whole of the body, limbs and tail above and below. In cranial characters the species more resemble *Pithecus senex* than *Pithecus entellus*.

Distribution. From Assam and Upper Burma southwards through Laos, Siam and the Malay Peninsula to Sumatra, Java and Borneo.

The actual number of species is doubtful; but within the area of British India I admit only two, which may be briefly contrasted as follows:—

(*a*) A little larger; hair on the crown directed backwards from the brow and forming a thick mat overhanging the occiput and marked off from the short hair clothing the cheeks; face entirely black ... *pileatus*.

(a^1) Smaller; hair on crown variable but never forming a mat as described above; eye-lids and usually the lips flesh-tinted (in British Indian forms) ... *pyrrhus*.

Pithecus pileatus, Blyth.

Semnopithecus pileatus, Blyth., *Journ. As. Soc.* Bengal, xii, p. 174, 1843, and xiii, p. 467, 1844.

Semnopithecus, *Presbytis*, *Pygathrix* or *Pithecus pileatus* of Anderson, Blanford, Forbes, Elliot and other authors.

A tolerably large langur characterized by the presence on the crown of the head of a thick continuous mat of backwardly directed or nearly erect hairs extending from the brow in front to the occiput behind and across the head between the temples and ears. Laterally this mat is defined by the shorter hair clothing the temple behind the eye and by the more or less, often greatly, elongated hairs of the cheek, and behind it overlaps the shorter hairs of the fore part of the nape.

The colour is variable but the prevailing tint of the upper side is grey, sometimes suffused more or less with black, especially on the crown; the lower side is whitish, buff or suffused with orange red, rarely grey like the upper side. The face is entirely black as in the Entellus-group, neither the eyelids nor the lips showing any trace of the flesh colour seen in all the British Indian representatives of the following species, *P. pyrrhus*.

Distribution. Assam, north and south of the Brahmaputra and Upper Chindwin to Tipperah, and Chittagong.

The evidence that this species belongs to the group with golden red newly born young was supplied by the birth of young of that colour from a pair kept for many years in the Zoological Society's Gardens, London.

Elliot classified *P. pileatus* with *P. entellus*, stating the two to be allied. They are certainly not closely allied. As living animals they have a very different facial expression. *P. entellus* has a narrow compressed nose, whereas in ***P. pileatus*** the nose is flat from side to side. The difference may be aptly compared to the difference between a European and a Negro.

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[1] In the first part of this paper (*Journ. Bomb. Nat. Hist. Soc.* XXXII, p. 474), this group was called the Auratus-group. But since the identity of *Pithecus auratus* in a matter of dispute, I think it advisable to change the name to the Pyrrhus-group.

This is borne out by the shape of the facial portion of the skulls. In ***P. pileatus*** the brow ridge is not prominent, the plane of the orbit is inclined upwards and backwards and the nasal bones are wide. In those respects the skull much more closely resembles the skull of *P. senex* than the skull of ***P. entellus.***

In his paper, quoted below, on the langurs of this group, Hinton suggested that the different forms, some of which were regarded as distinct species, would very likely prove to be merely subspecies of a single species. Believing this view to be quite correct, I have adopted it in this paper.

Key to the Subspecies of *P. pileatus*

- (*a*) Whiskers shorter, grey, not noticeably lighter in tint than the crown ... ... *shortridgei.*
- (a^1) Whiskers longer, whitish or reddish and rather sharply contrasted with the darker tint of the crown.
  - (*b*) No sharp contrast in colour between the upper and lower sides of the body and the outer and inner surfaces of the limbs; throat and breast whiter than the belly ... ... *brahma.*
  - (b^1) A sharp contrast between the areas mentioned above; throat and breast not paler than the belly. ... ...
    - (*c*) Lower side greyish white, tinged with buff on whiskers, throat and breast ... *pileatus.*
    - (c^1) At least the whiskers, throat and breast bright rusty red.
      - (*d*) General colour paler above, head and nape nearly uniform slaty grey, red suffusing underside at least to the groins ... ... *durga*
      - (d^1) General colour darker above, head blackish with grey patch on nape; red of the under side fading away on the abdomen. ... *tenebricus.*

Subspecies *pileatus*, Blyth.

Semnopithecus pileatus, Blyth, *Journ. As. Soc.*, Bengal, xii, p. 174, 1843.
Pithecus pileatus pileatus, Hinton, *Journ. Bomb. Nat. Hist. Soc*, xxix, No. 1, pp. 79–80, 1923.
Semnopithecus argentatus Horsfield, *Cat. Mamm. East Ind. Co.*, p. 7, 1851.

Distinguished by the pale colour of the whiskers, throat, underside of the body and inner side of the limbs which are sharply contrasted with the grey hue of the upper parts but are white or whitish and at most faintly tinged with buff or pale red.

Distribution. Assam from the Naga to the Garo Hills.

It is needless to repeat the history of this local race of *Pithecus pileatus* which was fully told by Hinton in 1923 when, on the evidence supplied by Blyth's original description based upon a langur of which the locality was unknown, he restricted the subspecific title *pileatus* to the Capped Langurs with pale under parts.

The colour, however, varies in different individuals assigned to this race. For example, a half-grown female shot by H. W. Wells at Mokokchung in the Naga Hills (5,000 feet) is pale slaty or smoky grey above and on the outside of the limbs and on the tail, with the head and hands a little darker. The whiskers, the whole of the lower side and the inside of the limbs are white and the white extends some distance up the flanks behind the arm-pit. On the hand the white of the inner side passes above the thumb and the fingers are patched with white. The feet are not darker above than the outside of the leg, and the inner edge of the foot and the toes are white. This specimen appears to be whiter below than Blyth's type of *pileatus*, the under side of which he described as 'dull fulvous white'. This was also an immature female.

An adult male from Mokokchung differs from the female in having the areas which in the female are white, tinged with buff or very pale red ; the hands and feet are darker and there is no white on the fingers or toes, but the extension of the white of the inner side of the leg along the margin of the foot above the great toe is retained.

An adult male from Tura in the Garo Hills, 1,400 feet (H. W. Wells) generally resembles the last-described but is paler on the legs and arms, the outside of the legs below the knees and the top of the feet being much greyer.

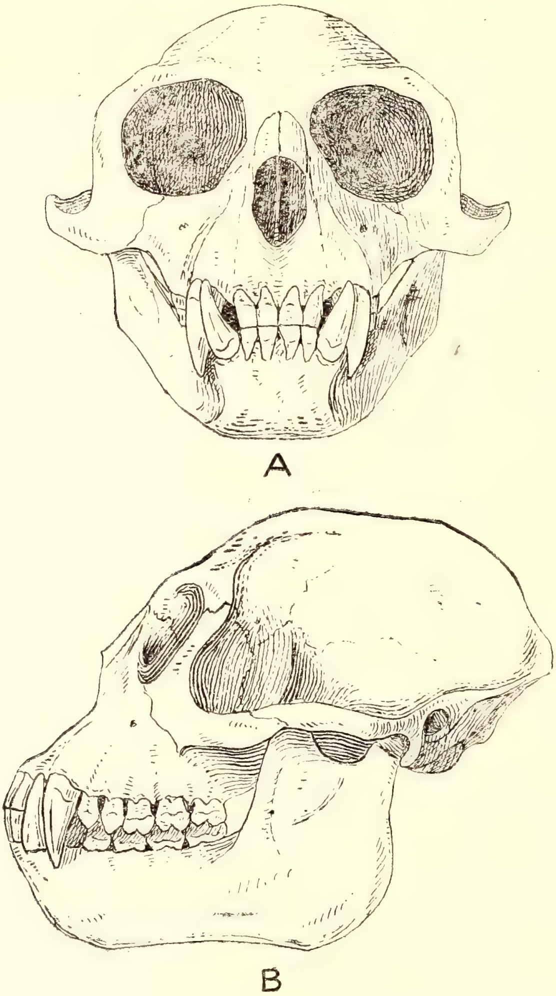
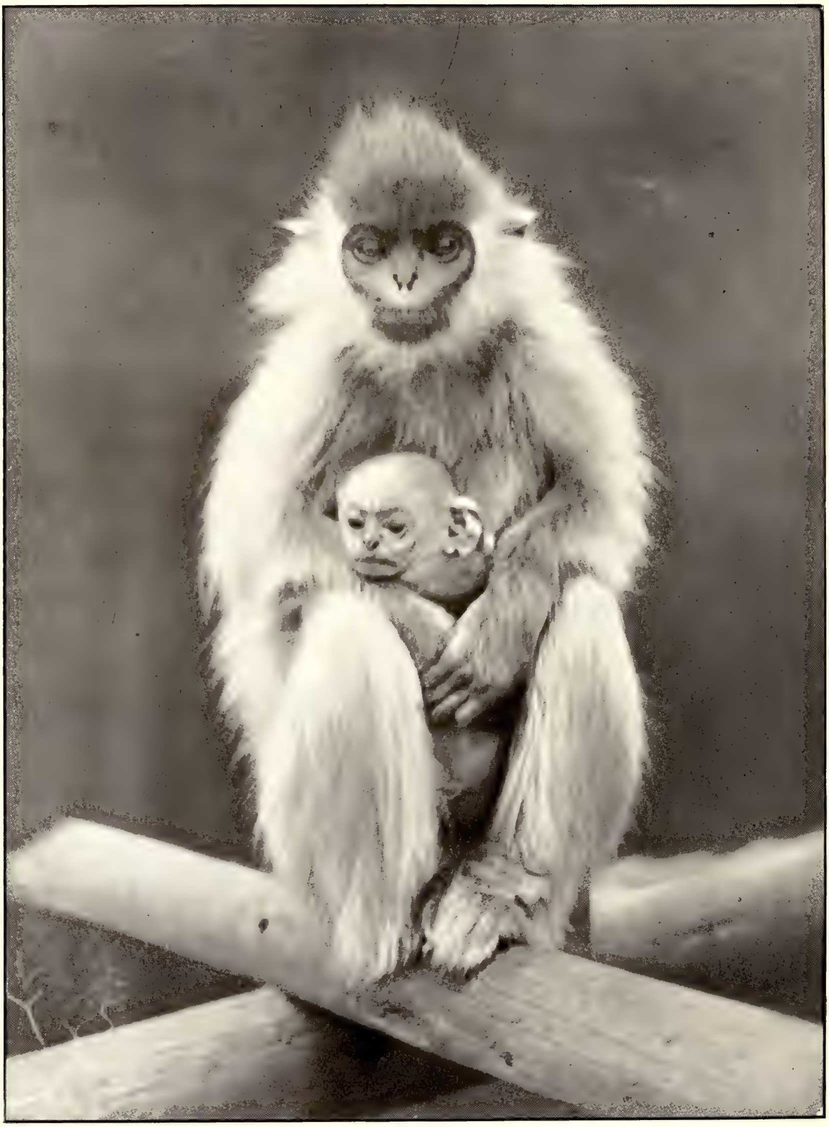


FIG. 1—A and B. Front and side views of skull of adult male *Pithecus pileatus pileatus* from Tura in the Garo Hills.

An immature male from Lait Kynsao in the Kasi Hills, 2,000 feet (H. W. Wells) is very like the adult male from Tura ; and an immature male from Konshong in the Jaintia Hills, 3,000 feet, has the outer side of the legs below the



THE CAPPED LANGUR AND YOUNG
(*Pithecus pileatus*)

knee greyer than in the older specimen from Lait Kynsao, and, as Hinton pointed out, the terminal portion of the tail is buff instead of blackish.

The redder hue of the under side of these young males from the Khasi and Jaintia Hills distinguishes them markedly from the immature but older female from the Naga Hills. They serve to connect the typical form of *pileatus* with the intensely red-bellied form recorded below as *Pithecus pileatus durga*. So also in a measure does the type of *argentatus* so far as can be judged from a specimen in a very poor state of preservation. This langur, an immature specimen, came from Sylhet, and the hair that remains on its under side suggests that, when freshly killed, the monkey was redder on the chest than are the adult males from the Garo and Naga Hills described above. It is also browner on the dorsal area. Since, nevertheless, the skin is not nearly so red beneath as in the typical red-bellied Capped Langur described below, I follow Wroughton in assigning *argentatus* to the synonymy of *pileatus* proper, at all events until fresh material of this langur from Sylhet shows that opinion to be wrong. It may be proved that the type of *argentatus* is an immature specimen of the red-bellied form which has lost its redness by fading.

The photograph of the Capped Langur *Pithecus pileatus* reproduced on Pl. III of this paper was taken from a specimen from Assam living in the Zoological Gardens, London.

Subspecies *durga*, Wroughton.

Presbytis pileatus, Blyth, *Journ. As. Soc.*, Bengal, xvi, p. 735, pl. xxvi, fig. 3, 1847.

Presbytis durga, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiv, No. 4, p. 655, 1916.

Pithecus durga, Hinton, *Journ. Bomb. Nat. Hist. Soc.*, xxix, No. 1, p. 79, 1923.

Pithecus pileatus saturatus, Hinton, *tom. cit.*, p. 81.

Distinguished from *P. p. pileatus* by the intensity of the redness of the areas which in the typical form are at most faintly tinged with that colour.

Distribution. Assam, north of the Brahmaputra from Lakhimpur to the Naga Hills and Cachar ; thence southwards into Tipperah and Chittagong.

From the evidence supplied by collectors it appears that this erythristic form occurs at lower levels than the typical form with the paler under side. For example, in the Naga Hills typical *pileatus* was taken at Mokokchung at an altitude of 5,000 feet and *durga* at Lakhuni at 2,000 feet.

In his tabular classification of the langurs of the *pileatus* group, Hinton, following Wroughton, described the colour of the whiskers and under surface of *P. durga* as ' ochraceous '. They are, on the contrary, markedly red, as red to all intents and purposes as in the form he named *P. pileatus saturatus*. The general colour of the upper side of both forms he described as dusky brown. As a matter of fact the type of *durga* is somewhat browner and dirtier looking than the comparatively recently killed langurs referred to *saturatus* ; but it must be remembered it is a specimen that belonged to Dr. Reid and has been many years in the British Museum and the difference may I think, be assigned to that cause or to discoloration due to the original method of preservations, such as that which gave rise to the difference between the skins of typical *Pithecus pileatus shortridgei* and those that Wroughton distinguished a *P. shortridgei belliger*. Also, I think, that soiling, or the make up, of the skin of *durga* explains the apparent difference Hinton noticed between it and *saturatus* in the width of the dusky brown dorsal area and the less sharp contrast when the skin is viewed from above, between it and the red hue of the flanks. The teeth of the type of *durga* are, it is true, a little larger than in *saturatus* ; but I feel tolerably sure that this will break down as a difference when more specimens come to hand.

Now the label on the type of *durga* bears the locality Upper Assam, Cachar. No doubt, however, as Wroughton decided, ' Upper ' was a mistake for ' Lower '. Taking, then the locality as probably Cachar, it is significant in view of the claimed identity between *durga* and *saturatus* that examples assigned to *saturatus* by Hinton were collected by the Mammal Survey at Lanka and Lamsahkang in North Cachar. It does not seem probable that two subspecies of *P. pileatus*, both intensely red below, occur in that district of Assam.

Although I have not seen examples of this form from Tipperah and Chittagong, I have added those countries to its distributional area because Blyth's description and coloured figure of specimens therein collected agree in all essentials, as Hinton also thought, with those to which he gave the name *saturatus*.

Blyth regarded these red langurs as identical with his typical *pileatus* of which he had previously seen a single specimen which was whitish below and came from an unknown locality; and from the material in his hands he inferred that the redness of the under side was characteristic of the male. In this he was mistaken because in a pair collected by H. W. Wells at Golaghat at 400 feet the male is not redder than the female.

This pair is also interesting in other ways. The male, although not redder than the female, is darker grey above and on the outside of the limbs and blacker on the hands, feet and tail, the feet being quite black, whereas in the female they are grey. Moreover, the female, apart from being brighter red, especially upon the sides of the neck and upper part of the flanks, is very like the adult male from Tura in the Garo Hills, 1,400 feet, which has been referred above to the typical form *pileatus pileatus*. Nevertheless, it is not so deep a red as an adult male from Lanka, 400 feet, in North Cachar. It may indeed, be described as intermediate between the male *pileatus* from Tura and the male *durga* (*saturatus*) from Lanka.

Individual variation in redness is attested by other specimens. For instance a female from Lamsahkang, 800 feet, in the Cachar Hills, has the red more diffused than in the male from the same spot. It invades the outer side of the leg replacing the normal grey of the limb which is retained in the male.

Subspecies *tenebricus*, Hinton.

Pithecus pileatus tenebricus, Hinton, *Journ. Bomb. Nat. Hist. Soc.*, xxix, No. 1, p. 81, 1923.

Distinguishable from the two preceding local races by the darker tint of the upper surface. The head, back, outer surface of the arm and hand, and the base of the tail are ashy black; the leg is somewhat greyer and there is a half-collar of grey tipped hairs defining the cap on the back of the head. The base of the whiskers, the throat, chest and shoulders are almost as deep a red as in *P. pileatus durga*, but the whiskers are especially grey as in *P. pileatus brahma* and it is noticeable that the redness of the under side is much less pronounced on the abdomen and inguinal region, which in the male are whitish and in the female pale red.

A young specimen is darkish grey above and on the outside of the limbs, but is whitish below with a yellow tinge on the cheeks and chest. It is darker above than a young male of *P. pileatus pileatus* of about the same age from Konshnong in the Jaintia Hills.

Distribution. Assam, north of the Brahmaputra; North Kamrup on the Matunga River, 1,200 feet and Bogra Nadi, 2,000–3,000 feet.

Subspecies *brahma*, Wroughton.

Presbytis brahma, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiv, No. 4, p. 654, 1916 and xxv, No. 4, p. 559, 1918.

Pithecus brahma, Hinton, *Journ. Bomb. Nat. Hist. Soc.*, xxix, No. 1, p. 79, 1923.

Tolerably uniformly slate-grey on the summit of the head, the back and the outside of the limbs and on the tail, but the limbs and tail darkening towards their extremities. The inside of the limbs paler grey but not sharply distinguished from the tint of the outer surface, with no pale line, involving the hallux on the inner side of the foot. Whiskers white and sharply contrasted close to the face as in the typical form of the species, but ashy at the tips as in *tenebricus*. The throat and chest whitish; abdomen the same but tinged with reddish buff especially on the flanks.

Distribution. Seajuli in the Dafla Hills, Lakhimpur, Assam, north of the Brahmaputra.

A single example only of this fine langur is known. Although regarded by Wroughton and Hinton as representing a distinct species, its characters are, in my opinion, of subspecific value; and I do not doubt that intermediates between it and the other races will be discovered.

The peculiarities in colour to be noted are the absence of sharp contrast in tint between the outer and inner surfaces of the limbs such as is seen in *pileatus*, *durga* and *tenebricus*, and the slight suffusion of the flanks and abdomen with pale red, the throat, whiskers and chest being white. In the other races which exhibit more or less pronounced erythrism, that tint is, at all events as a rule, more pronounced upon the whiskers, throat and chest than on the abdomen.

Subspecies *shortridgei*, Wroughton.

Presbytis shortridgei, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiv, No. 1, p. 56, 1915.
P. shortridgei belliger, *id. loc. cit.*, p. 57.
Pithecus shortridgei, Hinton, *Journ. Bomb. Nat. Hist. Soc.*, xxix, No. 1, p. 79, 1923.

General colour very much as in *brahma*, uniformly slate-grey all over the dorsal surface and on the head, but the ventral surface grey and the whiskers wholly grey and not appreciably differentiated in tint from the crown. No trace of erythrism anywhere in the pelage.

Skull as in the other races of *P. pileatus*.

Distribution. Upper Chindwin: Homalin (400 feet), Minrin (450 feet) and Hkamti (500 feet).

This fine langur is at once distinguishable from the other known forms of the species by the greyness of the whiskers which gives it a very different appearance. Apart from that, however, and the absence of the rufescence of the ventral surface, the colour is very like that of *P. pileatus brahma*. But in the latter, as in *P. pileatus tenebricus*, the tips of the whisker hairs are grey. Although no intermediates between *brahma* and *shortridgei* are known, there is no doubt, in my opinion, that they will be found, because the colour-differences between them are comparatively slight. Hence I regard *shortridgei* merely as a local race of *P. pileatus*.

The examples from Hkamti to which Wroughton gave the name *belliger* are browner in hue than the others; but this difference, as he afterwards learnt from the collector, G. C. Shortridge, is due to discoloration from smoke in the preparation of the skins.

Since the subspecies of *Pithecus pileatus*, above discussed, are to all intents and purposes alike in size, the approximate dimensions in inches of a few representative examples may be conveniently set forth in one table :—

Locality and Sex	Head and body	Tail	Hind foot	Ear	Weight
pileatus—					
Garo Hills, ♂ ...	28	41	7½	1⅓	...
Jaintia Hills, ♀ ...	23	35	7½	1⅕	21½ lbs.
durga—					
Lakhimpur, ♂ ...	27½	39	7¾	1⅓	...
N. Cachar, ♂ ...	23	41	9 (?)	1½	27 lbs.
,, ,♀ ...	20	...	...	...	...
tenebricus—					
N. Kamrup, ♂ ...	22½	36½	7	1½	19½ lbs.
,, ♂ ...	20	36	7	1½	..
,, ♀ ...	22½	34	7	1½	...
,, ♀ ...	18	28½	6½	1½	...
shortridgei—					
Upper Chindwin, ♂ ...	28½	41	8 —	1½	30 lbs.
,, ,, ♂ ...	27	40	8 —	1½	...
, ,, ♀ ...	26	38	7½	1⅓	21½ lbs.

The dimensions of the skulls in milimetres are as follows :—

Locality and Sex	Total length	Length of Palate	Length of Upper Molars	Orbital width	Zygomatic width	
pileatus—						
Naga Hills, ♂ ...	118	35	29	75	...	
Garo Hills, ♂ ...	115	35	28	70	89	
Garo Hills, ♀ ...	102	30	28	65	75	
durga—						
N. Cachar, ♂ ...	119	37	28	74	86	
Cachar (?), ♂ ...	117	36	30	74	86	type of *durga*.
Lakhimpur, ♂ ...	116	35	26	76	87	type of *saturatus*.
Naga Hills, ♀ ...	111	35	30	68	79	
tenebricus—						
N. Kamrup, ♂ ...	113	32	28	66	80	type; not full grown.
,, , ♀ ..	98	29	28	63	77	
brahma—						
Lakhimpur, ♂ ..	110	34	27	70	...	
shortridgei—						
Chindwin, ♂ ...		38	30	79	91	type of *shortridg*.
,, ♂ ...	115	37	28	73	85	
,, ♂ ...	114	36	29	75	92	type of *belliger*.
,, ♀ ...	104	32	28	71	77	

The body-measurements taken from freshly killed animals show that the males are larger than the females and that there is no great difference in size between the adults of all the races. An apparent exception to this is supplied by *tenebricus* in which an adult female is as large as the larger of the two males; but examination of the skull of this male, the type, shows that the basioccipital suture is still open, indicating that growth had not ceased.

Of *brahma* unfortunately no measurements in the flesh were taken. The skull which is that of an adult is decidedly small.

With regard to the tooth-measurements it will be noted that there is considerable difference between the types of *durga* and *saturatus* in that respect. But the teeth in the type of *saturatus* are old and worn and have probably lost a little in total length. Another male belonging to Mr. Hinton's series of *saturatus* is intermediate between the two and a female of the same set from Lakuni in the Naga Hills has the tooth-row as long as in the type of *durga* although the teeth are a little narrower.

Note.—The langur now known as *Pithecus potenziani*, Bonaparte (= *chrysogaster*, Lichtenstein), which was quoted as a synonym of *pileatus* by Anderson and was sceptically included by Blanford as a member of the fauna of British India on the erroneous record of the occurrence of the species in Tenasserim, is in reality an inhabitant of the Mentawei Islands off the west coast of Sumatra.

It is a very interesting species related, in my opinion, to *pileatus*. Its prevailing colour is jet black above, with a considerable amount of rusty red hairs on the ventral surface. The throat and cheeks are white, as in *pileatus*, and a white band extends from the temples over the brow, as in immature examples of *P. pileatus*, and, as in that species, the whiteness of the whiskers spreads over the base of the ear. The newly-born young too is golden.

One would be almost inclined to regard this langur as a small, insular melanistic race of *pileatus* were it not that the whiskers are shorter and more bushy and the crown of the head has no mat-like cap, but a compressed crest or tuft as in some forms of *Pithecus pyrrhus*. The species serves in a measure to link *P. pileatus* and *P. pyrrhus*.

Pithecus pyrrhus, Horsf.

Semnopithecus pyrrhus, Horsfield, *Zool. Res.*, Java, 1820, and of many subsequent authors, including Thomas and Wroughton, *Proc. Zool. Soc.* London, 1909, p. 372. (*Presbytis*).

Semnopithecus or *Presbytis maurus*, E. Geoffroy, 1812, and of many subsequent authors; but not *Simia maura* of Schreber.

Resembling *P. pileatus* in the uniform golden or golden red colour of the newly-born young but differing in being smaller and in the mode of growth of the hair on the crown which never forms a mat or cap as described under that species. Its arrangement is very variable. Occasionally there is a whorl on the forehead and not infrequently there is an erect tuft or crest on the summit of the head to which a good deal of importance has been attached, although in certain cases there seems no doubt that its occurrence is individually variable. Sometimes, again, the hair lies smoothly back from the brow to the nape of the neck, at others it is upstanding and roughly arranged like a mane. The whiskers are typically long and blend with the hairs of the crown. The colour varies from subspecies to subspecies, but is in some cases subject to individual variation to a pronounced degree, but the inside of the thighs never shows the whiteness so characteristic of the species of the following group, which *Pyrrhus* overlaps in range.

Distribution. From Upper Burma southwards and eastwards into Annam, Siam, the Malay Peninsula, the Sunda Islands and Borneo.

For the typical Javan form of this species Elliot (*Rev. Primates*, iii, p. 75, 1913) adopted the name *auratus* Geoffroy (1812), which has priority over *pyrrhus*. But his statement that the type of *auratus*, which he saw in Paris, is indistinguishable from examples of *pyrrhus* in the British Museum, is shown by the description of *auratus* to be untrue. And since, in my opinion, all the available evidence suggests that *auratus* belongs to the *Aygula*-group of Langurs, I do not propose to discuss it further here.

In Java *P. pyrrhus* is commonly either red or jet black, being addicted to erythrism or melanism. But a third variety is blackish, grizzled to a varying extent with buff or grey; and this variety passes into the Sumatran form known as *cristatus* or *pruinosus* which also occurs in the Malay Peninsula and is in my opinion only subspecifically distinguishable from a form from Siam and Cochin China named by M. Edwardes *germani* but usually quoted as *germaini*; and through a form from Annam, named *margharita* by Elliot, *germani* passes into the typically Siamese Langur assigned in this paper to *crepusculus* which is closely akin to the Burmese *phayrei*. On the other hand, in the Malay Peninsula *cristatus* passes into the Tenasserim form described below as *atrior* which is very similar to another Burmese form, *barbei*, and to the Malayan form *obscurus* and has been identified under both those names.

This brief epitome of the evidence of intergradation between the Javan Langur *pyrrhus* and others occurring in more northern countries of tropical Asia is the explanation of my adoption of the name *pyrrhus* as the specific title for all those forms.

A few words may be said about the Langur known as *obscurus*, because that name figures largely in the literature relating to the Langurs of British Burma. As stated below, it was applied by Blyth, Thomas and Blanford to Langurs as widely separated geographically as Bhamo and Tenasserim and this is eloquent testimony of the closeness of the affinity between these monkeys. Now the name *Semnopithecus obscurus* was given by Reid in 1837 (*Proc. Zool. Soc.*, p. 14) to a menagerie specimen of which the locality was unknown. Fortunately Martin in 1838 saw the specimen and identifiably described it (*Mag. Nat. Hist.*, ii, p. 440). The hair on the back of the head formed a crest and was ashy in tint, thus contrasting with the blackish-brown or brownish-black hue of the rest of the head and body. The middle line of the back was apparently browner, the outside of the thighs greyish brown, the hands and feet black and the tail dark ashy grey.

This description applies tolerably closely to many examples in the British Museum from various places in the Malay Peninsula, but the crest on the head is not usually present. This race of *Pithecus pyrrhus* does not apparently enter the British Indian area; but two closely related subspecies occur in its southern portion.

A photograph of the Dusky Langur *Pithecus pyrrhus obscurus* that was living in the Zoological Gardens, London is reproduced on Pl. IV of this paper.

KEY TO THE BRITISH INDIAN RACES OF *P. pyrrhus*

(*a*) A whorl or parting on the forehead behind the brow ... ... *shanicus*.
(*a*¹) No definite hair-whorl on forehead.
  (*b*) No distinct cap of pale hair on the back of the head and nape.
    (*c*) General colour lighter or darker, but lustrous grey, buff or brown in reflected light; lips flesh-coloured.
      (*d*) Grey, buff or greyish brown above, grey to white below; base of tail grey.
        (*e*) White or nearly white below; typically a tuft on the head ... ... *phayrei*.
        (*e*¹) Grey below; tuft on the head present or absent ... ... *crepusculus*.
      (*d*¹) Colour darker, brown above, deeper grey below; base of tail brown; no tuft ... *barbei*.
    (*c*¹) General colour deep brown to nearly black sometimes varied with grey specking; hair less lustrous; lips black ... ... *atrior*.
  (*b*¹) A sharply contrasted pale grey or buff cap on the back of the head and nape.
    (*f*) Body and arms blacker, legs not sharply contrasted with loins ... ... *sanctorum*.
    (*f*¹) Body and arms browner, legs grey and sharply contrasted with loins ... *flavicauda*.

Subspecies *barbei*, Blyth.

Presbytis barbei, Blyth, *Journ. As. Soc.*, Bengal, xvi, p. 734, 18; *id. Cat. Mamm. Mus. As. Soc.*, p. 14, 1863; *id. Mamm.* Birds, Burma, p. 11, 1875.

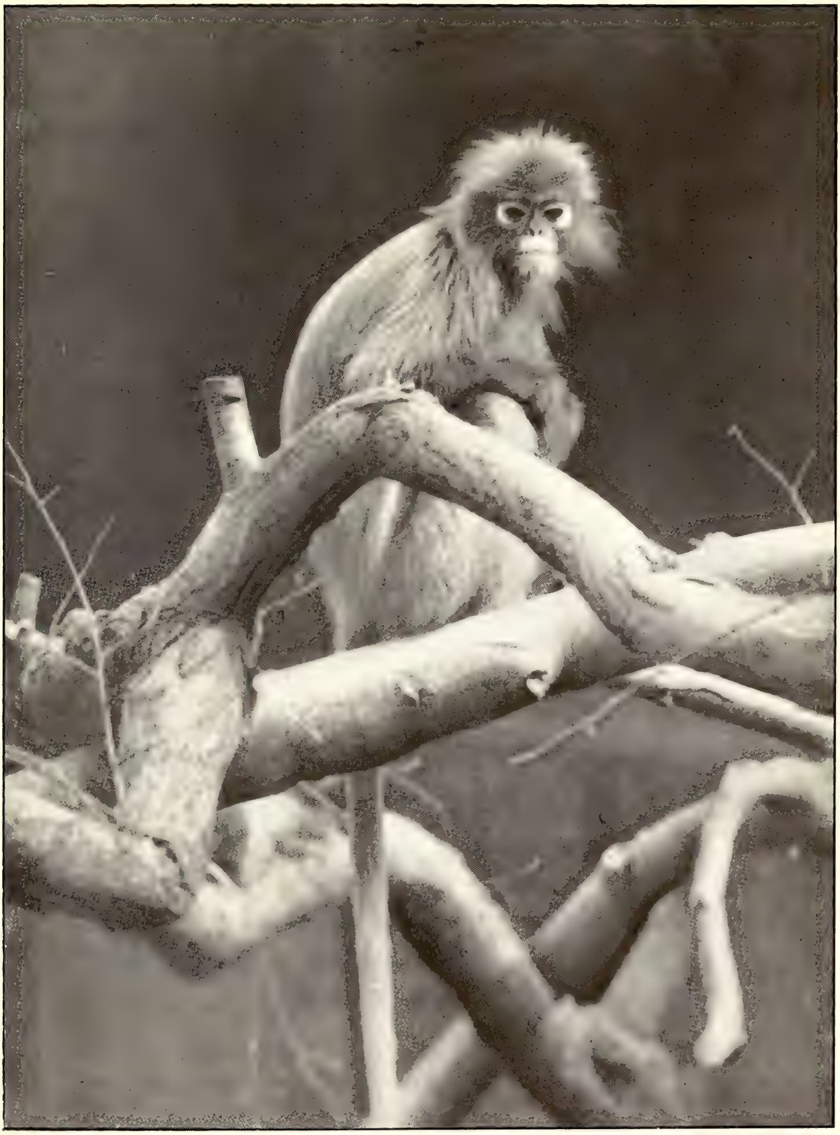
Semnopithecus barbei, Anders., *Ann. Zool. Res.*, Yunnan, p. 12, 1878 and *Cat. Mamm. Ind. Mus.*, pt. i, pp. 48–49, 1881 (in part); Blanford, *Mamm. Brit. India*, p. 39, 1891.

Presbytis melamera, Elliot, *Ann. Mag. Nat. Hist.* (8), iv, p 267, 1909, and *Rev. Primates*, p. 47, 1912.

With no whorl or parting in the hairs of the forehead and no crest on the crown of the head. Lips and eyelids flesh coloured and contrasting with the blackish hue of the rest of the face. General colour dark brown above with a pale buff sheen especially noticeable on the head and shoulders. The hind limbs and tail only slightly paler than the back. The under side dark grey. Hands, feet and brow black.

Distribution. Interior of the Tipperah Hills and from the Kakhyen Hills as far south as Bhamo.

There has been considerable doubt about the identity and geographical distribution of this langur. In his original description Blyth stated that the skins came from the Ye Province of Tenasserim; but later, from information received from the collector, he corrected this to the interior of the Tipperah Hills. This alteration was accepted by Anderson and Blanford, although in his description of the monkey Anderson cited Tenasserim as one of its areas. He probably had in his hands specimens of the dark race from Northern Tenasserim, described below, which is very like *barbei*. However that may be, it appears to me that Blyth's correction of the locality must be accepted, especially as the Rev. J. Barbe, after whom this langur was named, is known to have collected in Chittagong and the Tipperah Hills because he secured there examples of *Pithecus pileatus*, a species which certainly is not found in Tenas-



THE DUSKY LANGUR
(*Pithecus obscurus*)

serim. I cannot, therefore, agree with Wroughton's decision to take Tenasserim as the locality of *barbei*.

The acceptance of the interior of the Tipperah Hills as the locality of the type of *barbei* renders probable, on geographical grounds, the correctness of Anderson's identification as *barbei* of specimens which he collected in the Kakhyen Hills and on the Irawaddy above Mandalay. Until evidence to the contrary is forthcoming, I shall assume he meant the state of Mandalay which is just to the north of Bhamo. Now at a place called Cadu Ciaung, Bhamo, L. Fea long ago secured a species of langur, and one of his specimens, presented to the British Museum and identified by Thomas as *obscurus*, was subsequently described by Elliot as representing a new species to which he gave the name *melamerus*; and this specimen agrees sufficiently closely with Anderson's description of the specimens he identified as *barbei* as to leave little doubt that it is the same kind of langur. Acting, therefore, on the assumption that Anderson's Kakhyen examples were correctly named *barbei*, I have added *melamerus* to the synonymy of *barbei* and have taken my diagnosis of *barbei* from the type of *melamerus*, the only available specimen.

This specimen agrees with Blyth's original, but brief, description of *barbei* in the absence of the crest, in having the face and the under side coloured as in *obscurus*, in the whiteness of the 'interior base of the thigh', and in the tail being only slightly paler than the body; the shoulders and outside of the arms cannot be described as silvered, but other subspecies of *P. obscurus* vary in the grey or buff sheen of the upper side.

Anderson, who had access to the typical example of *barbei* in Calcutta and presumably identified the langurs he procured in the Kakhyen Hills by comparison with it, described the colour as blackish brown above with the sides and back of the head, the shoulders, fore-limbs, the lower parts of the hind limbs and the tail as greyish brown, the hands, feet, eyebrows and whiskers being black and the under parts nearly the same. But from his citation of Mount Mooleyit in Tenasserim as a locality for *barbei*, it may be presumed that his description applied also to examples from that area which, as stated below, appear to me to represent a distinct local race.

Blanford, to whom this langur was unknown, added to the difficulty of identifying it by placing it in his synopsis in a totally different section from *phayrei*.

Subspecies *phayrei*, Blyth.

Presbytis obscurus, Blyth., *Journ. As. Soc.*, Bengal, xiii, p. 466, 1844 (not typical *obscurus* of Reid).

Presbytis phayrei, Blyth., *Journ. As. Soc.*, Bengal, xvi, p. 733, pl. xxxvii, fig. 3, 1847; also of Anderson and Blanford (in part).

Presbytis phayrei, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiii, No. 3, p. 464, 1915 and *op. cit.*, xxiv, p. 297, 1916.

Semnopithecus holotephreus, Anders., *Zool. Res.*, Yunnan, p. 27, 1877.

A crest or tuft on the crown of the head but no parting on the forehead; lips flesh coloured and eyes partly or wholly encircled by the same tint. The general colour is variable, being lighter or darker brown above with a varying extent of greyish sheen over the back and the outside of the limbs, the tail is dark like the back but sometimes paler at the base or throughout. The under side is distinctly white or whitish and contrasted strongly or moderately with the colour of the flanks.

Although closely related to *barbei*, this race may be distinguished from it by the whiteness of the under side and by the presence of the erect crest on the crown of the head.

Distribution. Arakan; the Bassein district of Pegu; Prome; Mount Popa.

Under the name *Presbytis, obscurus*, Blyth gave a very good description of this langur, having skins of adults and young collected in Arakan by Capt. Phayre; and Blanford shot specimens in the Bassein district of Pegu west of the Bassein river; but the specimens from Moulmein he referred to *phayrei* belong, I think, to another local race, *crepusculus*.

In the British Museum there is a half grown specimen from Arakan which was received long ago from the Asiatic Society of Bengal and was for many years exhibited in the public gallery. It may be regarded as topotypical, since Blyth gave no definite spot in that district for his type specimen. It is dull, lustreless and dark brown above and white below, the white contrasting with the dark hue of the flanks; thus it agrees closely with Blyth's coloured figure of the type of *phayrei*. An adult from the S. Zmayi Reserve, 500 feet (J. M. D. Mackenzie) is also like Blyth's type in those respects, being dark brown above with the white of the ventral surface strongly pronounced and sharply contrasted. It has also a considerable amount of white on the inner side and back of the thighs. Also an immature individual from a spot 30 miles S.E. of Prome, 300 feet (J. M. D. Mackenzie) presents the same style of coloration as the example from Arakan; but an adult from the same locality is not so white below and is greyer above. Individual variation between specimens from the same place is also shown by two from Yin on the Lower Chindwin collected by Mr. Macmillan. One is dark brown above and on the outside of the thighs, but is not so white below as in the specimens mentioned above; the other is greyer on the back and legs. This specimen and the greyer of two examples taken 30 miles S.E. of Prome link the typical darker forms with a good series collected by G. C. Shortridge at 4,961 and 4,981 feet on Mount Popa, and the one from Yin on the Lower Chindwin (G. W. Dawson) mentioned above. These are brown with a distinct grey sheen all over the upper side, the amount of the grey sheen varying individually; the under side is white or whitish but not very strongly contrasted with the flanks.

These Mount Popa langurs, as originally pointed out by Wroughton and Shortridge, differ from the langurs from the Shan States to the north for which I retain Wroughton's name *shanicus*, in having no whorl of radiating hairs on the forehead and in exhibiting the upstanding crest on the crown. They are also somewhat paler above and whiter below. They also differ from *barbei*, as here understood, in being greyer above, whiter below, and in possessing the crest. They come nearest to the form described below as *crepusculus*, differing from it apparently only in having the under side whitish instead of ashy grey.

I have added *holotephreus* to the synonymy of *phayrei* to eliminate it from the list of so-called species of *Pithecus*. The following considerations justify, in my opinion, this course. (1) The description mentions no character by which it can be definitely separated from *phayrei*. (2) The locality of the specimen was unknown. (3) According to Elliot the type was not found in the Calcutta Museum where it was supposed to be preserved. Elliot suggested that it might be a synonym of *barbei*; but the 'pale yellowish grey' tint of the under side agrees better with *phayrei*. The type, moreover, had a crest on the crown of the head which is present in *phayrei* but was not recorded in the case of *barbei*.

Subspecies *shanicus*, Wroughton.

Presbytis barbei, Wroughton, *Journ.*, *Bomb. Nat. Hist. Soc.*, xxiii, p. 465, 1915.
Presbytis shanicus, Wroughton, *Journ.*, *Bomb. Nat. Hist. Soc.*, xxv, p. 47, 1917.
Pithecus melamerus, Wroughton, *Journ.*, *Bomb. Nat. Hist. Soc.*, xxvii, p. 552, 1921. (Not *melamerus*, Elliot).

A dark brownish form closely resembling *barbei*, as represented by the type of *melamerus*, in colour, but distinguished from it and from all the other British Indian races of *Pithecus pyrrhus* by possessing on the forehead a naked spot whence the hair radiates in all directions as in the *entellus* langurs.

Distribution. North Shan States in Upper Burma.

The example of this race which first came to hand and was identified as *barbei* by Wroughton was collected by G. C. Shortridge at Ngapyinin opposite Kyonk Myoung to the east of the Irawaddy. Shortridge noticed that it differed from langurs he collected on Mount Popa, which were identified as *phayrei*, in possessing the frontal whorl, in having no upstanding crest on the crown, and less pallid skin round the eye, the area being reduced to half circles on the inner side of those organs. Nevertheless, in his description of *phayrei*, Blyth stated very definitely that the eyes were surrounded on the inner side by flesh-coloured skin.

When Shortridge subsequently secured similar specimens in the North Shan States, at Séen, Gokteik (2,133 feet) and Pyaung yaung, Wroughton decided to give a new name to the series because he ascertained from the late Dr. Annandale that the type of *barbei* in the Calcutta Museum has no frontal parting in the hairs. He therefore named them *Presbytis shanicus*, selecting a Séen specimen as the type of the species.

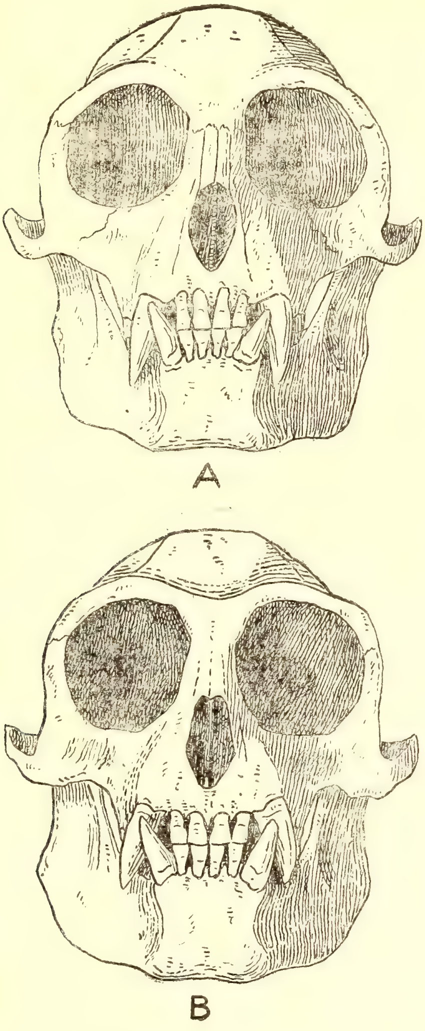


FIG. 2.—Front view of skull of adult male *Pithecus pyrrhus shanicus* from Gokteik in the North Shan States, two-thirds natural size.

B.—The same of *Pithecus pyrrhus atrior* from the Ye Forest, Tennasserim.

Later, however, he came to the conclusion that these North Shan langurs were identical with the form from Cadu Ciaung, Bhamo, which Elliot had described as *Presbytis melamerus*; and in Wroughton's summary *melamerus* appears in the table amongst the *entellus* group which present the frontal whorl. But as I have stated above, the type of *melamerus*, which is in the British Museum, has no parting on the forehead at all comparable to that shown by adults and young from the North Shan States.

It must be admitted that this difference between langurs so alike in colour and so close to one another in geographical distribution is very singular; but on the available evidence, I do not think it would be justifiable to ignore the character. I have, therefore, decided to admit *shanicus* as a subspecies of *Pithecus pyrrhus*.

Subspecies *crepusculus*, Elliot.

Presbytis phayrei, Tickell, *Journ.*, *As. Soc.*, Bengal, xxviii, p. 428, 1859.
Presbvtis crepuscula and *crepuscula wroughtoni*, Elliot, *Ann. Mag. Nat. Hist.*, (8), iv, pp. 271–272, 1909; and *Rev. Primates*, ii, pp. 84–85, 1912 (under *Pygathrix*).

Intergrading with *phayrei*, but on the average paler and greyer above and not so white below, the ventral surface being grey and sometimes hardly paler than the dorsal.

Distribution. Northern Tenasserim and adjacent areas of Siam and Laos.

Two examples of this race preserved in the British Museum and collected by Davison at an altitude of 5,000 feet on Mount Mooleyit, to the west of Moulmein, were identified by Blanford as *phayrei* and reasonably considered by him to be the same as the langur from near Moulmein referred to *phayrei* by Tickell.

These specimens were named *Presbytis crepuscula* by Elliot. The two differ in tint being in different stages of pelage, as Elliot pointed out. One is tolerably uniformy brown all over the upper surface, and on the arms, hands and feet some rusty brown hairs are retained, so that the extremities are not black as is typically the case in *P. pyrrhus*. The other, in fresh pelage, is greyer, with black hands and feet, and scarcely differs from Mount Popa examples of *phayrei* except that the belly is greyer and the base of the tail the same tint as the loins. There is also no upstanding crest on the head. Another example collected by A. S. Vernay at an altitude of 1,000 feet at Lampha in Tenasserim is almost identical with the greyer of the two Mount Mooleyit specimens.

This race also spreads into Siam. From this country the British Museum has a large number of specimens, exhibiting considerable range in the tint of the upper side from various localities. A brownish specimen from Pacheburi was named *crepuscula wroughtoni* by Elliot, but I can find no evidence to justify its separation from *crepusculus*. In a series of three examples collected by A. S. Vernay on the Mewong River 40 and 53 miles east of Um Pang at 800 and 1,000 feet, and one 28 miles southeast of Um Pang at 1,750 feet, no two are quite alike, the tints of the back varying in greyness and brownness and sheen and of the arms in darkness according apparently to the age of the pelage. Another obtained by Mr. Vernay at Kempenpet on the Klong Klung River is characterized by a marked buffy sheen over the neck and shoulders. Others obtained by K. G. Gairdner in Seeswad at about 2,000 to 3,000 feet are dull, dirty-looking skins, their tint being due probably either to the method of preservation or to oldness of the pelage.

The only other specimen I need refer to is a beautiful skin with long greyish hair obtained by Messrs. J. Delacour and W. Lowe at Xien Quang Koa in Laos. This has recently been identified by Thomas as *Pithecus phayrei.*

It may be added that the tuft on the head usually regarded as characteristic of *phayrei* may be present or absent in these specimens It may be always present and erect in the living animals, but it is not always preserved in dried skins.

Subspecies *flavicauda*, Elliot.

Semnopithecus obscurus, Blanford, *Mamm.*, *Brit. India*, p.42, 1888 (in part).
Pygathrix flavicauda, Elliot, *Proc. U. S. Nat. Mus.* xxxviii, p. 352, 1910, and *Rev. Primates*, ii, p. 50, 1912.

Closely related to typical *obscurus* and *sanctorum*, with a similar pale grey or greyish buff patch on the back of the head but differing in the very sharp contrast between the grey or greyish buff tint of the tail and of the outer side of the hind legs and the blackish loins. The sides of the back are blackish brown, but the centre is browner and this tint, only somewhat paler, pervades the shoulders and arms. The head, apart from the back of the crown, is black, as also are the hands and feet, and the under side is greyish brown.

Distribution. Southern Tenasserim, Mergui Archipelago and parts of Peninsular Siam.

The British Museum possesses many examples of this race. One collected by Davison at Bankasun (Bankachon) in S. Tenasserim was ascribed by Blanford to *obscurus*. Others from the same locality were collected by G. C. Shortridge who also got one in Tenasserim Town and another at Banlaw on the Great Tenasserim River. These specimens exhibit variation in the distinctness of the pale areas. There is also an example from King Island, Mergui, collected by Mr. C. Primrose; and Elliot records the race from Sir William James Islands, Mergui. The type of his *flavicauda* came from Trong in Lower Siam.

Subspecies *sanctorum*, Elliot.

Presbytis sanctorum, Elliot, *Proc, U. S. Nat. Mus.*, xxxviii, p. 351, 1910; *Rev. Primates*, p. 55, 1913.

Mostly blackish above with some brown on the middle of the back behind the shoulders and the outside of the limbs at most a little paler than the upper side of the body, the hands and feet being, as usual, black. But the tail is pale buffy grey and the patch on the head whitish. The lower side is uniformly brownish grey.

Distribution. St. Matthew Island in the Mergui Archipelago.

I have not seen an example of this Langur, my description being adapted from the remarks of Elliot who declared that in colour *sanctorum* is very like a race inhabiting Terautau and Langkawi Island in the Straits of Malacca, named by Thomas *Presbytis obscurus carbo*, except that the nuchal crest is creamy white and the tail pale buffy grey. The specimens of *carbo* in the British Museum represent a dark insular race closely akin to the mainland race *obscurus*, and, in view of Elliot's statements, I have been compelled to judge of the colour of *sanctorum* from them.

Subspecies *atrior*, nov.

A very dark form nearly uniformly coloured deep, dusky brown all over the upper parts and the outside of the legs, with less sheen on the hairs; but the outer side of the arms, especially about the elbows, is paler than the shoulders and back. The under side is dark, dusky greyish brown. The tail is at most only slightly paler than the body.

Distribution. Northern parts of Tenasserim and adjoining areas of Siam.

Type. Ye Forest, 500 feet, in the island of Moulmein in the Ataran Division of Tenasserim. (G. F. R. B. Thurling. B. M.).

This langur may be the same form as the specimen, or specimens, from Mount Mooleyit referred by Anderson to *Semnopithecus barbei*. In the darkness of its tint it is very like the example from Bhamo described by Elliot as *melamerus*, which I identify with *barbei*; but it is somewhat darker above and below, has little or no white on the back of the thigh, and the skin of the lips and chin is black in all the examples seen and not flesh-coloured as in *barbei*, *phayrei* and other races described above.

In addition to the type above mentioned the British Museum has an example collected by Davison at the foot of Mount Nwalabo, Tavoy, Tenasserim, which is a little greyer on the tail and under side than in the type; also a specimen from N. Lat. 14° 25′ and E. Long. 98° 45′, to the east of Tavoy, in Siam; and one from Maw to Maw Lai in Siam, both collected by K. G. Gairdner, and another without locality obtained by the same collector. The example from Nwalabo in Tavoy shows a certain amount of grizzling on the head, tail and elsewhere and is of special interest as a connecting form between the type of *atrior* and Malayan examples of *cristatus*.

The above described British Indian subspecies of *P. pyrrhus* are all very similar in size. The dimensions in inches of a few of the largest specimens measured in the flesh may be conveniently set forth in one table :—

Locality and Sex	Head and Body	Tail	Hind foot	Ear	Weight
shanicus					
Gokteik, N. Shan States, ♂	24	30	6½	1½	19 lbs
,, ,, ♀	23	31	6½	1¼	15 ,,
phayrei					
Mt. Popa, Upper Burma, ♂	24	32	7	1¼	17½ ,,
,, ,, ♀	21½	31	6	1	15½ ,,
crepusculus					
Lampha, Tenasserim, ♀	22	31½	6	1¼	16½ ,
flavicauda					
Bankachon, Tenasserim, ♂	25	31	7	1¼	
,, ,, ♀	21½	30½	6½	1¼	

The recorded measurements of other specimens of these subspecies agree so closely with those quoted that it is needless to insert them in the table. Unfortunately the only available specimen assigned to *barbei* was not measured in the flesh, but the size and proportions of the skin are similar to those selected for record.

The dimensions in millimeters of some of the skulls are as follows :—

Locality and Sex		Total Length	Length of Palate	Length of Upper Molars	Orbital Width	Zygomatic Width	Height and Width of Orbit
shanicus							
Gokteik	♂	101	33	27	65	79	23 × 22
,,	♀	94	28	26	52	71	24 × 20
phayrei							
S. Zamayi,	♂	108	35	29	62	81	23 × 21
Chindwin,	♂	100	33	25	64	80	23 × 22
flavicauda							
Tenasserim Town,	♂	105	33	27	60	78	26 × 24
Bankachon,	♂	102	31	26	65	80	25 × 22
,,	♂	100	32	27	58	75	24 × 21
,,	♂	98	33	26	58	74	21 × 21
,,	♀	96	28	27	58	71	25 × 21
,,	♀	92	30	26	55	71	22 × 19
atrior							
Ye Forest,	♂	102	34	28	65	78	26 × 24
Nwalabo,	♂	—	32	27	61	76	25 × 22

These skull measurements attest general similarity in size between all the subspecies. An additional column showing the dimensions of the orbit has been added because variation in the size of the orbits has been considered to be a character of systematic importance. The orbits, for example, are larger in *atrior* than in *shanicus* or *phayrei*. In the skull of *atrior* from the Ye Forest, Tenasserim, the orbit is 3 mm. higher and 3 mm. wider than in the skull of *phayrei* from the Southern Zamayi Reserve, although the general dimensions of the skull of the latter exceed those of the former, except in the width across the orbits. And this difference in the size of the orbits gives a very different look to the full face view of the skull, the skull with the large orbits being not only wider across the orbits but narrower between them as well, and has more prominent brow-ridges. These characters, however, like other cranial characters, are individually variable, as is clearly shown by the records of the specimens of *flavicauda* from Tenasserim. These skulls also indicate that other characters which have been relied upon are unreliable. For example, the second on the list, from Bankachon, has the palate wider and the tooth-rows more arched than the first from Tenasserim Town, whereas the fourth on the list, a younger animal, from Bankachon, resembles in these particulars the one from Tenasserim Town.

III. The AYGULA-group

Differing from the *Entellus*-group and the *Pyrrhus*-group in the colour of the newly-born young which exhibits a definite pattern of white and black or brown, extending as a median spinal stripe from the back of the head on to the upper side of the tail and generally, perhaps always, passing on to the outer surface of the arms, to a greater or less extent, forming a cross-shaped mark. In the adults of most of the langurs of this group the white above and below is more or less obliterated by the extension of the black or brown pigment, but the inner side of the thigh is almost always white and sharply contrasted with the tint of the outer side. Usually there is an erect tuft of hair on the back of the head and a median whorl or a pair of whorls on the forehead. When there is a pair of whorls the hair typically rises into a crest between them. The skull is generally distinguishable from that of the *Entellus*- and *Pyrrhus*-groups by a marked convex swelling on the base of the nasal bones.

Distribution. Indo-china and the Malay Peninsula through Sumatra, Java and Borneo.

This group does not extend so far to the north as the *Pyrrhus*-group but overlaps its range in the countries above mentioned.

The name of the group is taken from a Javan species, *Pithecus aygula*, described as *Simia aygula* by Linnæus in 1758.

The precise status of the many species and subspecies of this group has not yet been ascertained. But since only one species the correct name of which appears to be *femoralis*, occurs within the area of British India, the characters of the other representatives of the group need not be considered here.

Pithecus femoralis (Horsfield), Martin.

Semnopithecus femoralis, Martin, in Charlesworth's *Mag. Nat. Hist.*, ii, p. 436, 1838 (first description of the langur named *femoralis*, but not described, by Horsfield, Appendix, *Life of Sir T. S. Raffles*, p. 642, 1830).

Semnopithecus or *Presbytis femoralis* of Anderson, Blanford and other authors, at least in part.

Semnopithecus neglectus, Schlegei, *Mus. Pays-Bas.*, *Simiæ*, p. 47, 1876.

The whole of the upper side is dark blackish brown becoming black on the extremities of the limbs and tail ; the face is black with the lips flesh-coloured and clothed with white hair, and the eyelids also are to a certain extent pallid. The under side is also mostly blackish brown, or deep brownish grey, frequently with a white stripe extending down the chest on to the belly which tends to become lighter and may be quite white where it merges with the pubic region. The inner side of the arms is frequently pale from the axilla to the elbow and the inner side of the thighs is always clean white and this white may extend as a narrow stripe down the inner side of the leg between the knee and the heel, and on the thigh the white does not blend with the dark tint of the outer side but is sharply marked off from it by a straight white line. The under side of the tail is dark throughout like the upper.

The coat is shaggy. There is a thick erect tuft on the crown of the head and a pair of whorls on the forehead, the hair rising into a median crest between them.

Distribution. Southern Tenasserim, the Malay Peninsula, Peninsular Siam, and possibly Sumatra.

Horsfield's type of this species, an immature animal, is in the British Museum. It is labelled Sumatra but very likely came from the Malay Peninsula. At all events it very closely resembles examples from Perak, Selangore, Trang and other places in Malaya.

In addition to the typical form there are other subspecies in the Malay Peninsula and closely related species or subspecies occur in Sumatra, Borneo and the smaller adjoining islands.

Subspecies *keatii*, Rob. and Kloss.

Presbytis neglecta keatii, Robinson and Kloss, *Journ., Fed. Malay States Mus.*, iv, p. 174, 1911.

Pithecus femoralis keatii, Wroughton, *Journ., Bomb. Nat. Hist. Soc.*, May 1915, p. 702.

Very closely resembling the typical form, but with the lower side more pigmented, there being no white on the inner side of the arm between the axilla and the elbow, no white line on the chest and hardly any white on the belly which is pigmented backwards to the public region where its dark tint is strongly contrasted with the white on the inner side of the thighs.

Distribution. Tenasserim : Malewoon and Bankachon ; also Kao Wang Hip in Peninsular Siam.

In the British Museum there are examples of this subspecies, which is of doubtful value, from the above-mentioned localities.

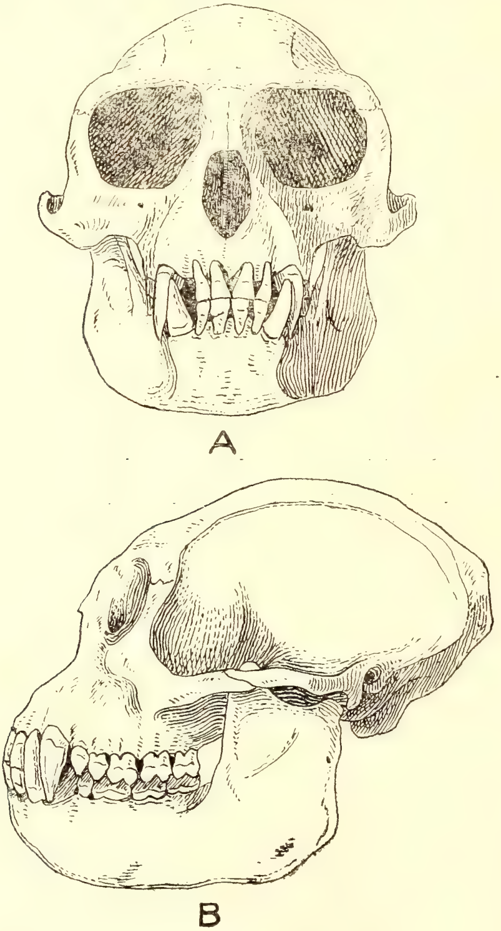


FIG. 3 A and B.—Front and side view of skull of adult male *Pithecus femoralis keatii* from Bankachon in Tenasserim.

The approximate dimensions in inches of two examples are as follows :—

Locality and Sex.		Head and Body	Tail	Hind foot	Ear	Weight
Malewoon,	♂	22+	31	7	1¼	15½ lbs.
Bankachon,	♀	22	33	7	1¼	14½ ,,

The measurements in millimetres of two skulls are :—

Locality and Sex		Total length	Length of Palate	Length of Upper Molars	Orbital Width	Zygomatic Width
Bankachon,	♂	95	28	25	64	76
Kao Wang Hip,	♀	92	28	25	62	70

(*The end*)

THE BIG BULL OF SEMBUTOLLAVU

BY

C. P. Gouldsbury

(*With a plate*)

Short green grass in the swamps, with elephant grass—over six feet high as a rule—on the adjoining slopes, intersected here and there by small patches of jungle, the latter taken into cardamom cultivation by the neighbouring ryots—a tiny river running all along the valley—such was the home for many a year of the bull of this story.

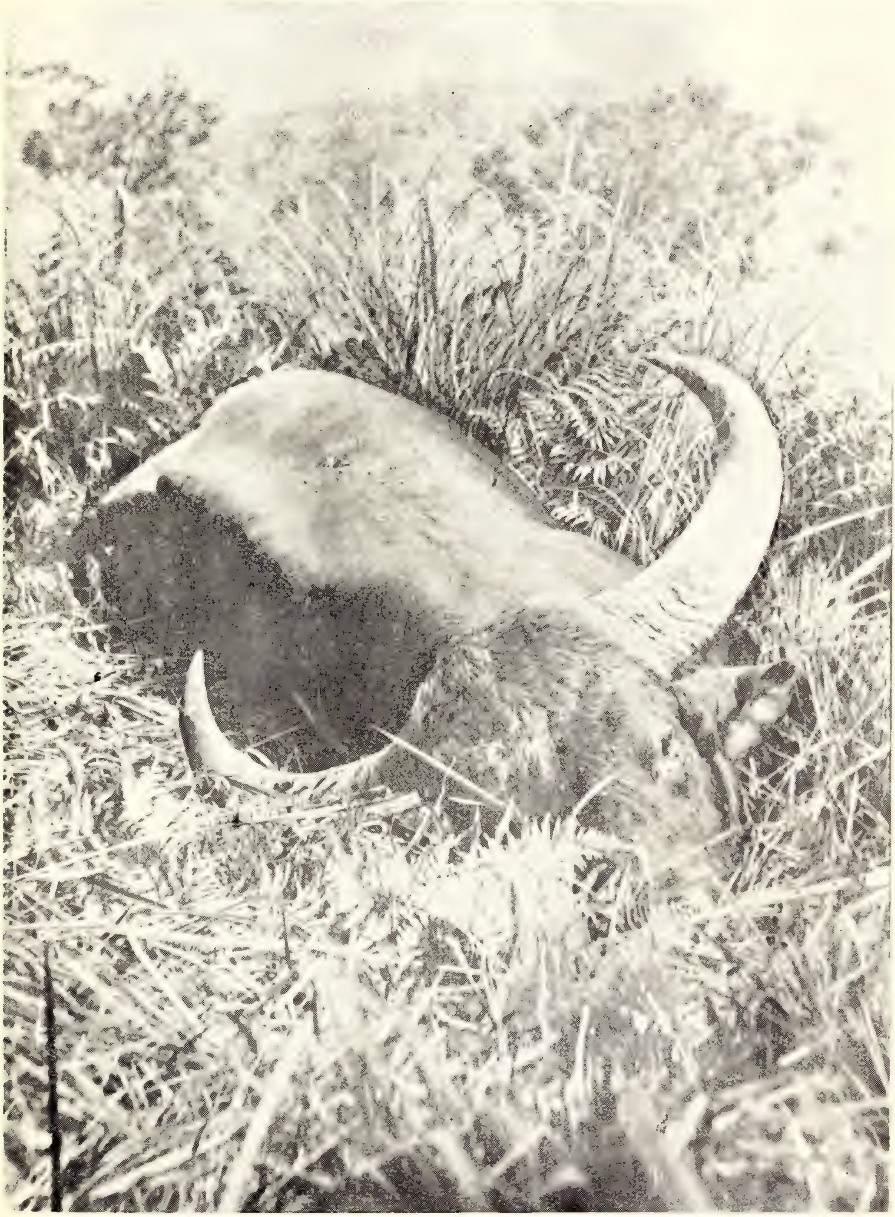
During the dry months all the grass that would burn was set alight, but the swamps always kept their cover of green and the adjoining patches of cardamom jungle with the undergrowth alone cleared—afforded welcome shade for bison and incidentally elephant, during the scorching midday heat.

The valley in which the bison roamed was roughly five miles in length, and some two miles broad, broken up by numerous small grassland re-entrants.

From a 'spotting' point of view the country left a lot to be desired, as a herd of elephants might be, and very often was, in close proximity, to the blissful ignorance of the stalker, who would in all probability only discover it as the light was failing, and a return to camp was contemplated. On several occasions a long and tedious detour was therefore unavoidable, and with the short Indian twilight closing down suddenly into darkness, with a herd of cow elephants in the vicinity, with small calves at heel, or possibly a solitary young tusker anxious to throw his weight about, the return to camp was not always without incident.

Similarly it was inadvisable to leave camp in the mornings before the light was sufficiently strong to allow one to see at least 100 yards all round. Failure to observe this rule, resulted in a friend walking practically on to a round grey object which he took, in the early morning light, to be a rock, and which suddenly turned itself into a solitary bull elephant, and one too with an unsavoury reputation. M's retirement from the scene was rapid, and not altogether noiseless, but a nasty accident might very easily have occurred, had he actually stumbled on the animal in the half light.

Bison, of sorts, were always in the valley, but master bulls, although frequenting the entire length of it, were difficult to pick up, unless they were with the cows during the rutting season—April and May, and even during these months they would seldom lie up during the hot hours in the midst of the herd, but usually cleared off to an isolated patch of jungle soon after dawn, joining up with the cows again about dusk. At other times of the year the master bull was somewhere in the valley but, with the elephant grass, well over



THE BIG BULL OF SEMBUTOLLAVU

Tip to tip across forehead	...	75″.
Widest spread (outside)	...	43¼″.
Girth	...	20″.

ones head it was more by luck than judgment that he was ever spotted, and if he was, it was usually at dusk in the failing light, and the presence of elephants necessitated the greatest care in a stalk, even if the latter was at all possible before the light went, the almost inevitable result being that the bull was left alone that night, in the hope that he would be in the vicinity at early dawn next morning—a hope which never materialized in the many attempts I made during the hot weather months.

It was, to say the least of it, very tantalizing to get reports in from my shikaris regarding the size of one old bull bison in particular —solitary at the time—on three occasions when my men had been down they had sat on a small rocky hill looking down on the old bull who, as luck would have it, had come out to feed in a large swamp, known as Sembutollavu, at five o'clock in the afternoon.

The following two week-ends, my only chance of getting away, were spent fruitlessly in trying to get in touch with him. On one occasion he was heard moving about in cardamom jungle near the swamp, but did not come out before dark, and on the next, a solitary tusker was near the ground usually frequented by the bull, and it meant getting in between the elephant and the swamp, thereby giving my wind to what we knew was an elephant with a decided ' penchant ' for chasing human beings, although at that time he had not actually been proscribed by Government as a rouge.

The close season for big game in the district of which I write, begins on May 31, and the bull being again reported near the Sembutollavu swamp, in company with eight or nine cows, my shikaris went down for four days to see if they could locate him, in which case two were to keep in touch with him, the third returning to me on the Friday. As luck would have it, the week-end fell on the last two days of the month, which would enable me if necessary to get in three stalks, Saturday afternoon, Sunday morning and evening.

At Friday midday, along came the third shikari, and his expansive grin was the forerunner to the welcome news that the bull had been seen with his cows, on the Wednesday afternoon, in Sembutollavu.

The grass on the ridge above the swamp was long, and the herd had apparently been lying out for some hours, before it actually came to the stream to drink. The men had again seen the bull on Thursday evening but this time he had evidently left the cows during the previous night, as he rejoined them from a cardamom jungle some distance away, and some time after they themselves had been out. On this particular evening the men had heard a tiger, and sent word to me that with a tiger about, it was probable that the big bull would now stay with the herd, and not leave the cows by themselves. Chances therefore of at any rate seeing him appeared good, and all arrangements were made for tents and kit to be sent down on Saturday morning.

I started for camp early that afternoon, and reached it about 3.30 p.m. after a stiff climb up one ridge, and a steep descent down another, the journey taking three hours, and the going as rough as it could be. It was a relief to eventually see the tents nestling under a small bluff, well out of elephant country, on the edge of a stream, and a greater relief to meet Velandy, my head shikari, with the news that he had again marked down the bull, with his cows, in Sembutollavu, the previous evening.

He was very reticent regarding the size of the head, merely remarking that through the telescope it looked a good one.

A hurried tea, the heavy rifle, a double barrelled ·577 by Jeffery pulled through, and its cartridges collected, the lantern tested, and various odds and ends such as glasses, the telescope, and raincoat distributed amongst the shikaris, a move was made to the swamp, some two miles from camp.

Taking up my position with Velandy on a ridge commanding the swamp, the second shikari was posted on a small hill to my rear, to warn us in the event of elephants, which at the time were numerous in the valley, feeding out of some of the cardamom jungles and thus cutting off our return to camp at dusk.

Hardly had Velandy and I settled down when the glasses revealed seven or eight cow bison lying in high elephant grass, under some stunted thorn trees. For a long time it was difficult to pick out the bull, but Velandy at last spotted him with the telescope, lying out somewhat to our right. He was under a small tree, and beyond the colour of his hide proving him a bull, it was impossible to get a satisfactory view of his head. For over an hour we lay and watched him. Occasionly a horn would show up above the high grass as he swung his head at a tormenting fly, but before the glasses were on him, the horn would sink back again.

At last the cows appeared to be inclined to feed. One by one they got up, and moved slowly down the hill opposite us to the swamp, through which ran a small stream. Even now the high grass gave me only occasional glimpses of them, as they moved from clump to clump.

A glance at the bull, who was still lying down, and I turned back to the cows, trying to make out exactly how many there were.

Whilst watching them through the glasses I felt Velandy's hand on my knee, and the telescope was pushed towards me.

'He is up, Dorai. Look at his head.' Bringing the telescope on to the bull, I gave a gasp, and whispered to Velandy 'He is well 'over 40 inches. Why didn't you tell me when I asked you in camp.'

'I knew he was, Dorai, but if I had said so, before you actually 'saw him yourself, you would have called me a liar,' and Velandy grinned broadly at me.

The bull stood for a moment rubbing his horns against the tree under which he had been lying, and then sauntered down hill towards his cows. Even though he towered above them, it was only possible to see the ridge of his back over the elephant grass, but as he was head on, I got a very fine view of his horns through the telescope, and, in addition to their spread, the width between tips struck me as being exceptional.

The cows, seemed in no hurry to come down to me, and as it was much too far to risk a shot at the bull, covered as he was by the elephant grass, there was nothing for it but to possess my soul in patience.

As the bull closed up with the cows, the latter started grazing quietly down towards me, evidently making for a small opening in the grass at the edge of the stream, which the glasses showed me to be a ford, from the numerous tracks, and mud on the blades of grass. If they actually came down to the ford, they would be within seventy yards of my position, but from their rate of progress, this would take a considerable time, and the wind was none too steady. Above the ford and on the line they were taking was a small tree, near which the grass seemed shorter.

This I estimated to be about 120 yards from me, and after searching it carefully through the telescope, I decided to take the bull, if, and when, he got as far, and also if he turned broadside to me.

The cows were zigzagging about grazing, and I hoped, provided the wind kept steady, that the bull would give me the chance I wanted.

In the meantime I made myself as comfortable as possible, and explaining the position to Velandy, told him to watch the result of my shot when I did fire, and to be ready with spare cartridges.

After what seemed an interminable age the cows one by one, crossed the shorter strip of grass, and the bull gradually approached it. On reaching the small tree, he lay down under it. This was a shock, as I had no idea how long he proposed remaining in this position. It was quite impossible attempting to shoot as the grass though much shorter here than where I had first seen him, was still too long to enable me to get a clear sight on him, in addition to which the target had now been considerably reduced in height. Velandy suggested whistling to get him on to his feet, but in this event I was certain he would face towards me—a difficult shot to make certain of at the distance. As he lay he was broadside on, and my only hope was to cover him, and wait. The wind was fairly steady, and I got Velandy to watch him with the telescope, and tell me if he made any movement to get up. In the meantime I got ready to cover him as soon as he showed any signs of moving.

The cows were by now gradually feeding away from him, which evidently prevented him from settling down, and it was not long before Velandy whispered that he was on his knees. As his back heaved up I covered what I thought was his shoulder—the grass made things a bit difficult and holding my breath, let go at him. I felt as I pulled the trigger that I had held a little low, and let him have the second barrel as he swung round away from me, but this was a palpable miss.

The bull went up the hill, keeping the small tree between us, and showing so little the effect of the first shot that Velandy declared I had missed him. Two more barrels failed to hit him, and amidst wails from Velandy that he was a record bull, that I was wasting ammunition on him, etc., etc., I put in a last despairing shot as he was going uphill away from me, aiming between his horns, with the 200 yards leaf up, and a very full sight. He bucked to this shot, swayed, and then came rolling down the hill. There seemed no life in him through the glasses, so letting the cows—which had lumbered up the hill after the bull when I started shooting—clear off, we went up to look at him. The grass when we got into it, was so long that we had to make a detour to the top of the ridge and then come down on the tracks made by the bull when rolling. On reaching him, a few sticks thrown at him elicited no response, but on trying to get at his head, I found this tucked under him, and impossible to move.

As the shikaris caste would no permit of their handling him, I sent the second man, who had joined us when I started shooting, to the nearest jungle for a length of green cane, which on arrival I knotted round a hind leg, telling the men to heave at the other end. This was almost too successful, as the slope of the ground very nearly brought the bull on top of us. However it had the desired effect of releasing his head, and I gave another gasp when I put the tape on it. The widest spread outside showed 43¼ inches. Girth 20 inches, tip to tip between horns 34 inches, tip to tip of horns across the forehead 75 inches, and length on outside curve of longer horn 30¾ inches.

My first shot was low down behind the shoulder, and my exceedingly lucky last one had caught him near the spine, forward of the rump, and as we discovered later, had travelled, and set up in the lungs.

In addition I cut a spherical 12-bore bullet out from just under the skin of the flank—a bullet evidently fired into him from a shot gun, by a cardamom ryot, most of whom own guns, ostensibly to protect themselves from wild elephants.

As it was then getting dark, and elephants were about, we left the bull where he lay, to return and secure the head and mask early next morning.

My return to camp was with mingled feelings. Joy at having outwitted the old bull predominated, but at the same time there was the inevitable feeling of sorrow that he would roam his territories no more. In this particular case, not a vestige of his enormous body was to be wasted, as a pencilled chit from camp to a friend on a neighbouring estate, early the following morning, produced an incredible number of pariah coolies, and the head and mask being removed, I left for my bungalow knowing that it would not be long before every particle of meat, including the intestines, would be on its way to gladden the hearts, and soothe the insides, of numerous coolies, and provide them with at least one square meal.

The accompanying photograph gives a good idea of the bull's head and also of the flies that discovered him, though these proved no deterrent to the swarms of coolies that later got down to work on him.

A curious feature was the presence of raw red spots each the size of half a crown on all four legs of the bull from ' stocking ' to fetlock. These were denuded of hair and were raw though not actually bleeding.

INDIAN DRAGONFLIES

BY

LT.-COL. F. C. FRASER, I.M.S., F.E.S.

Part XXX

(*With three plates*)

(*Continued from page 459 of this Volume.*)

Genus—MICROMERUS, Ramb.

Micromerus, Ramb. Ins. Nevrop. p. 238. (1842) ;—Selys., Syn. Cal., p. 64 (1853) ;—Id. Mon. Cal. p. 233 (1858) ;—Walk. List. Neur. B. M. iv, p. 652 (1853) ;—Kirby, Cat. Odon., p. 115 (1890) ;—Will. Proc. U. S. Nat. Mus. vol xxviii, p. 172 (1904) ;—Ris. Ent. Mitteil. V. Nr. 9/12 (1916).

Characters as for the subfamily, the epistome however, much more developed than in *Rhinocypha*, much more projected, so that a deep fissure intervenes between the frons and nasus. Fore and hind-wings similarly shaped, very long and narrow, reticulation moderately open ; fore-wings of male, in most species, tipped with black, otherwise all wings of both sexes completely hyaline (except in *snellemani* and *bisignatus*, both ex-Indian species, in which the wings are marked with broad blackish brown fasciæ as found in many species of *Rhinocypha*) ; antenodal nervures 4 to 7 in number ; sectors of arc arising from a common point, where the arc is strongly angulated at a little above its middle ; *1A* undulated from its origin ; petiolation ends proximad of the first antenodal nervure ; intercalated nervures few in number and found only near apices of wings ; *Riii* arising widely distad of node ; pterostigma absent in forewings of male except in those species where the apices are not tipped with black, present and very elongate in the hind, and in all wings of the female.

Mesothoracic triangle absent or reduced, uncoloured ; legs long and slim, usually all femora and tibiæ pruinosed white on the flexor surfaces. Abdomen short and stout, much shorter than wings, fusiform, depressed, narrowing very gradually towards the 10th segment. Anal appendages very similar to those of *Rhinocypha*, superiors twice the length of segment 10, pincer-like, cylindrical and pointed at apices ; inferiors obtuse, less than half the length of superiors. Vulvar scale very robust, shaped as for *Rhinocypha*.

Larva very similar to that of *Rhinocypha* (*vide* Plate III.)

Distribution. Southern Asia from Western India to Borneo and New Guinea. Most Indian species appear to have origin from *lineatus*, which is only found typically from Lower Burma within Indian limits. Elsewhere it comes from Java and Siam, several subspecies or races occurring throughout Burma, Continental India and Ceylon. In the latter island, due to insulation, we find a surprising development of the genus, the species found there not being apparently closely related to *lineatus*.

Their habits do not differ in any respects from those of *Rhinocypha*, and they are found in similar habitats.

Genotype—*Micromerus lineatus* Burm.

The present position of the nomenclature of *Micromerus* and *Libellago* is uncertain. The first mention of the latter genus is found in Selys, *Mon. Lib. Eur.* p. 200 (1840), wherein he gives a short description of the genus and cites *Agrion lineata* as the genotype, but also gives *fenestrata* and *fulgipennis* (now classed as *Rhinocypha*. but at that time as *Agrion*.) as belonging to the same genus. *Lineata* had however been described by Burmeister as a *Calopteryx* and Selys committed an error in assigning it to *Agrion*. That he did so is perfectly clear, from the fact that he refers to the *Mon. Lib. Eur.*, when describing genus *Micromerus* in the Mon. Cal., p. 233. It seems perfectly clear therefore that *lineata* as referred to in the *Mon. Lib. Eur.* was Burmeister's *Calopteryx lineata* (*Micromerus lineatus*), and equally clear that it was given as the genotype for *Libellago,* and this being the case, *Micromerus* becomes a mere synonym for *Libellago*, and the latter name, for what it now stands, is therefore preoccupied. As I have already committed myself, in the present Monograph, to the present use of the names, a change of seats in midstream might cause endless confusion and I have therefore decided to let things stand as they are. In a future revision however, it will become necessary to rectify these errors. *Micromerus* becoming *Libellago* and a new name being chosen for the latter, for which I would suggest *Chlorocypha.*

Key to Indian species of *Micromerus.*

1.	Abdomen marked with bright orange or brick-red...	2
	Abdomen marked with bright citron yellow or greenish	3
2.	Greater part of abdomen bright orange ; middorsal carina of abdominal segments not marked with black. (Burma.)	*M. aurantiacus.*
	Abdominal segments bearing large spots of brick-red ; dorsal carina of all segments black. (Ceylon.)	*M. greeni.*
3.	Male with 6 antenodal nervures to all wings ...	4
	Male with 5 antenodal nervures. (Burma, N. India.)	*M. lineatus lineatus.*
4.	Black tip to forewings of male 4 to 5 mm. in length.	5
	Black tip to forewings of male only 3 mm in length.	6
5.	Humeral stripe present at its middle ; posterior lobe with a large dorsal spot ; thoracic markings orange. (Nicobars.)	*M. blandus.*
	Humeral stripe absent ; posterior lobe of prothorax unmarked ; thoracic markings citron yellow or green. (Andamans)	*M. andamanensis.*
6.	Small insects, hindwing less than 18 mm. in length ; linear spot on hinder border of occiput with a median anterior prolongation ; abdominal markings citron yellow (Continental India and Ceylon.)	*M. lineatus indica.*
	Larger insects with hindwing more than 20 mm. in length ; linear spot on hinder border of occiput without median prolongation ; abdominal markings bluish or bluish-green. (Ceylon.) ...	*M. finalis.*

Micromerus lineatus lineatus, Burm. (*Calopteryx lineata* Burm.) Handb. Ent. ii, p. 826 (1839),—Selys. (*Agrion lineata*) Mon. Lib. d'Europe, p. 200 (1840),—Ramb. (*Micromerus lineatus*) Ins. Nevrop., p. 238 (1842),—Selys. Syn. Cal., p. 65 (1853),—Id. Mon. Cal., p. 237 (1858),—Id. Bull. Acad. Belg. (2), xxvii, p. 665 (1869).—Walk. (*Libellago lineata*) List. Neur. Ins. B. M., p. 653 (1853),—Ramb. l. c. (*Micromerus uxor*) p. 239 (1842),—Kirby Cat. Odon. p. 115 (1890),—Selys. Ann. Mus. Civ. Genov. (2) x (xxx), p. 62 (1891),—Laid. Fascic. Malay. (Zool), pt. 1, p. 197 (1903),—Will. Proc. U.S. Nat. Mus., vol. xxviii, p. 171, figs. 5 and 6 (1904),—Laid. Rec. Ind. Mus., vol. xiii, p. 39 (1917),—Fras. *Ibid.*, vol. xxvi, p. 483 (1924).—*Micromerus obscurus*, Kirby Proc. Zool. Soc. Lond., p. 328 t. 33, f. 1(1886).—Id. Cat. Odon., p. 115 (1890).

Male. Abdomen 15 mm. Hindwing 17 mm.

Head. Labium dull brownish yellow to blackish ; labrum blackish brown, the anterior border finely yellow ; epistome black, the anterior facet blue black metallic, above velvety black ; frons and vertex velvety black—with 2 transverse oval citron yellow spots on former near middle line and a large oval spot on outer side of each posterior ocellus ; occiput black with a large postocular spot subtriangular in shape, on each side separated from, more or less narrowly, a median crown-shaped spot. The latter spot rather variable, in the type, transversely elongate with a median spot in front of its middle, but in others, confluent with this spot and with additional triangular points on either side.

Prothorax black marked with citron yellow as follows :—The border of the posterior lobe very finely except below where it is expanded into a pyriform spot ; a large transversely oval spot on dorsum of posterior lobe, this part being raised into an oval boss coated with fine hairs ; a narrow anterior collar, and a large subtriangular spot on each side of middle lobe.

Thorax black marked with citron or greenish yellow as follows :—The whole of antealar sinus, the middorsal carina finely, a narrow ragged antehumeral stripe incomplete above, a small upper antehumeral spot, a norrow curved posthumeral stripe incomplete below. Laterally nearly the whole of the mesepimeron which shows a narrow wedge of black at its middle and a hook-shaped or triangular-shaped invasion of black above ; lastly the whole of metepimeron except the anterior sutural line and the ventral border narrowly. Beneath yellow.

Legs black, flexor surfaces of tibiæ and of the anterior pair of femora pruinosed white.

Wings hyaline, the bases of all, nearly to level of node, palely tinted with amber ; the apices of forewings (except in tenerals where no marking is visible) tipped with black as far proximad as inner end of pterostigma of hindwing but falling short of hinder border of wing. Pterostigma absent in forewing, black tumid and elongate in hindwing where it covers from 2 to 2½ cells. Costa of forewing gradually thickened towards the site where pterostigma would ordinarily be ; discoidal cell traversed once ; nodal index, 5 antenodal nervures, 8 to 10 postnodals.

Abdomen black and bright greenish or golden yellow, the latter colour prevailing on the anterior segments, the former on the hinder. Segment 1 with the apical border narrowly and the sides broadly yellow, segments 2 to 5 with the latero-ventral borders and the intersegmental sutures narrowly black, the carina also finely black from segment 2 to 4, or in tenerals from 2 to 6, but arrested short of apical border where the black expands or is connected to two wing-like projections, so that this together with the carinal stripe form inverted capital ' Ts ' (in some specimens, the arms of the ' T ' are slightly separated from the stem, but this is rare). Segments 5 and 6 with two large dorsal yellow spots tapering apicad, enclosed by an expansion and confluence of the carinal T-spot with the apical ring and latero-ventral black ; segments 7 and 8 may show smaller similar spots, but adults have these unmarked, as also 9 and 10.

Anal appendages black, superiors twice the length of segment 10, separated widely at base, converging at apices which are turned slightly in, cylindrical and very slightly tapered. Inferior appendages only half the length of superiors, closely apposed at bases and again at apices so as to enclose a minute foramen, blunt, broad at base, narrowed thereafter.

Female. Abdomen 13 to 16 mm. Hindwing 18 to 22 mm.

A stouter, more robust insect than the male, marked very similarly but the yellow more extensive.

Head with the same markings as for male but with the following additional spots :—The labrum and labium, the former with a small basal median tongue of black ; the anterior surface of epistome (which in the male is metallic blue) ; the bases of mandibles, cheeks, basal joints of antennæ, a large spot on either side of epistome and two large diamond-shaped spots on front of frons, narrowly separated from the smaller hinder pair.

Prothorax, thorax and legs as for male.

Abdomen black marked with yellow as follows :—The apical border and sides of segment 1 ; the dorsal carina on segments 2 to 7 ; a longitudinal stripe on dorsum of 8 and 9, whilst that of 10 is unmarked. Laterally the segments yellow with a large apical spot notched in front on segments 2 to 7, bifid on segment 8, and present only as a small yellow spot on sides of 9 and 10. (Briefly the abdomen may be said to be yellow with two longitudinal bands of black and black articular rings at the intersegmental nodes.)

Anal appendages black, twice as long as segment 10, pointed, widely separated throughout. Legs black, the flexor surfaces of femora and tibiæ yellow.

Wings entirely hyaline, the basal area, especially along the costa slightly tinted with amber ; pterostigma, present in all wings, elongate, black or yellow framed in black according to age, covering 2 or 3 cells ; 6 antenodal nervures, 9 to 10 postnodals.

Distribution. Throughout the Sondaic Archipelago and the adjacent mainland, Java, Sumatra, Siam, Annam, Burma and North India. Kirby's *obscurus*, described from a teneral specimen, from northern India, is identical to specimens which I have received from Dehra Dun, Cachar and Upper Burma. It differs only in the limitation of black markings due to tenerality and is undoubtedly *lineatus*. In Peninsular and Southern India we find a distinct subspecies replacing typical *lineatus*, which I have named *indica*. The two Ceylon forms show sufficient differences as to deserve specific rank.

Micromerus lineatus indica, subsp. nov. (*Micromerus lineatus*) Fras. Rec. Ind. Mus., vol. xxvi, p. 483 and pl. xxiv, fig. 4 (1924),—Laid. *Spolia zeylanica* (*M. lineatus*, Burm.), vol. xii, part 47, pp. 354, 355 (1924).

Male. Abdomen 14 to 16 mm. Hindwing 15 to 18 mm.

Head very similar to that of *lineatus*, labium ochreous, labrum dark brownish yellow, black at base; a more or less obscure spot on either side of epistome, the anterior facet of which is metallic blue as in *lineatus*; eyes brown but with a bluish metallic lustre in certain lights; bases of mandibles and cheeks narrowly yellow; the oval spots on frons reniform in shape and often a second pair of smaller rounded spots behind them; crown-shaped mark on occiput with an elongate median point, but no lateral points, or if present then very short, usually connected to the postocular spots.

Prothorax, thorax and legs as for type *lineatus*, the femora pulverulent white at basal halves only.

Wings as for *lineatus* but the apical black spot of forewings distinctly longer (absent in tenerals); nodal index differing slightly, in Kanara specimens 6 antenodals in the forewings, 7 in the hind, less commonly 5 to 6 in the hind; in Deccani specimens, almost always 6 in both wings and 10 to 14 postnodals. The amber tinting at base usually very marked, upto or even beyond node; discoidal triangles traversed once; pterostigma as in *lineatus*.

Abdomen. (As in *Libellago*, so in *Micromerus* specialization seems to have confined itself almost entirely to the colouring and markings of the abdomen.) Segment 1 bright golden yellow with the base narrowly and a small quadrate black spot; segments 2 to 6 bright citron yellow, the dorsum golden green, often very green, 2 with a thick middorsal dumb-bell-shaped black marking confluent with a narrow basal ring, the ends of which are prolonged along the sides nearly to apical border, and separated very narrowly from the ventral border, segments 3 to 5 with broad middorsal stripes confluent with narrow basal rings and expanded somewhat apically, whilst laterally near the apical border, a small ventro-lateral spot of black is seen; segments 6 and 7 with basal subdorsal wedge-shaped yellow spots enclosed by a fusion of the middorsal black with an elongated lateral spot, segments 8 to 10 black. In some specimens the middorsal marking of segment 2 is narrowly bisected with yellow, and there is nearly always an indication of the beginning of such a line apicad.

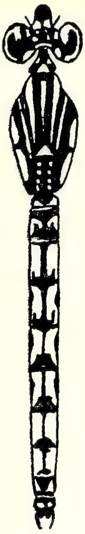
Anal appendages not differing from *lineatus*.

Female. Abdomen 13 to 17 mm. Hindwing 17 to 20 mm.

Head. Labium yellow; labrum yellow with a small median basal point or tongue of black; epistome entirely yellow in front, similarly coloured above but here edged with black anteriorly and laterally, its dorsum clouded with light brown and the base narrowly dark brown with a tongue of the same colour running obliquely forwards and outwards; frons with two large quadrate citron yellow spots, separated narrowly by a black median stripe which is confluent anteriorly and posteriorly with an equally narrow black stripe, the whole thus forming a black anchor-like mark, accentuated by the outer corners of the hinder portion angulated forwards like the flukes of an anchor; markings of rest of head similar to those of male but an additional pair of spots situated between ocelli. Eyes brown.

Prothorax entirely similar to the male. Thorax similar but lateral markings rather more extensive. Legs yellow, the femora lined externally with dark brown.

Abdomen largely yellow with black markings as follows:—Segment 1 with a large quadrate spot on dorsum, the base narrowly and the apical border laterally; segment 2 to 8 with the dorsum very broadly but bisected by a narrow middorsal carinal yellow line which runs as far as segment 9, but on the last two segments is fusiform, tapering apically and basad; laterally a stripe more or less defined, broadening abruptly subapicad and not quite reaching the base of segments. On segment 9 this line expands basad and becomes confluent with the dorsal black to enclose a large rounded subdorsal yellow spot, segment 10 black with two transversely elongate subdorsal yellow spots.



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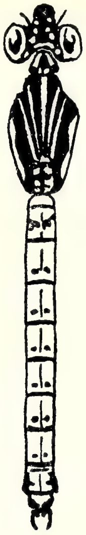

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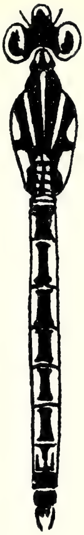

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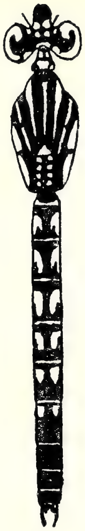

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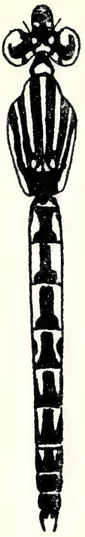

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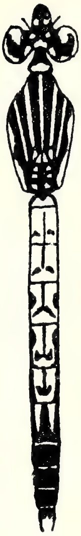

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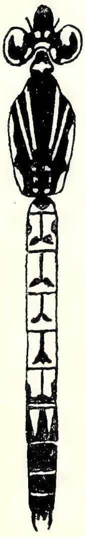

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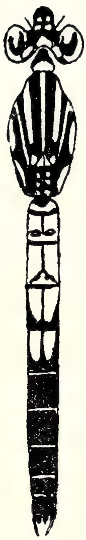

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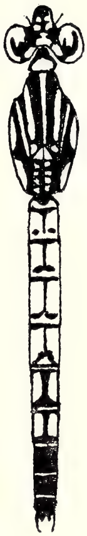

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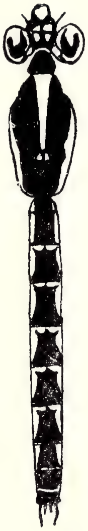

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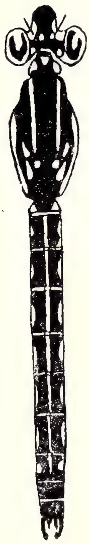

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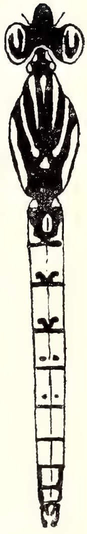

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FIG. 1. *Micromerus greeni*, Laid. (Ceylon.)
,, 2. ,, *aurantiacus*, Selys. (Burma.)
,, 3. ,, *andamanensis*, Fras. (Andamans.)
,, 4. ,, *finalis*, Selys. (Ceylon.)
,, 5. ,, *lineatus indica*, subsp. nov. (Kanara.)
,, 6. ,, ,, *lineatus*, Burm. (Dehra Dun.)
,, 7. ,, ,, ,, ,, (Cachar.)
,, 8. ,, ,, ,, ,, (Java.)
,, 9. ,, ,, ,, ,, (Siam.)
,, 10. *Calocypha laidlawi* (Fras.) (Kanara.)
,, 11. *Libellago asiatica*, Selys. (Burma.)
,, 12. ,, *curta*, Selys. (Uganda.)

Wings hyaline palely amber tinted ; pterostigma present in all wing, creamy white in a black frame which expands somewhat proximad, over 2 cells ; nodal index,—6 to 7 antenodals, 9 to 10 postnodals ; discoidal cell traversed once in all wings.

Anal appendages blackish brown, pointed, tapered, widely divaricate, rather longer than segment 10.

Vulvar scale robust, with a large spot of yellow laterally.

Distribution. A very common insect throughout South India especially in the Western Ghats and Deccan. It is common on the river banks at Poona and Khandala, less common in Coorg, Kanara and Malabar.

Laidlaw reports it from Ceylon, Haragama, July, and remarks on its difference from type *lineatus lineatus* Burm., from Burma and Siam.

It appears to be double-brooded, as it may be found pretty well throughout the year. The abdominal markings will easily distinguish it from typical *lineatus*. Type and co-type in B. M. from Poona.

Micromerus lineatus blandus Selys, Syn. Cal., p. 64 (1853) ;—Id. Mon. Cal., p. 254 (1854) ; Walk. (*Libellago blandus*) List. Neur. Ins. B. M. iv, p. 652 (1853) ;—Laid. Rec. Ind Mus., vol. xiii. p. 39 (1917).

Male. Abdomen 17–18 mm. Hindwing 20–21 mm.

Female. Abdomen 12–15 mm. Hindwing 19-21 mm.

I have not seen this species, which in the Selysian description is said to closely resemble *lineatus*, a fact which leads me to describe it as a subspecies of the typical form from Java.

It is a more robust insect and differs from *lineatus* as follows :—

The yellow stripe on the cheeks bordering the eyes absent ; prothorax black, its middle lobe unmarked but the large dorsal tumid spot on the posterior lobe extending forwards as a point ; thoracic markings more orange than yellow ; the humeral stripe incomplete above and below, present in its middle third only; the anterior of the two broad lateral fasciæ broken up into three large spots, the upper very minute ; dorsal markings of abdomen broader ; apical black spot of forewings longer than broad, about 4 mm. in length ; pterostigma longer, covers about 5 cells in the hindwings ; 6 antenodal nervures in all wings.

Female very similar to that of *lineatus*. The yellow markings more restricted the humeral stripe absent, the anterior of the two lateral fasciæ divided up into two spots ; the dorsal black of segments 3 to 6 narrower, nearly interrupted on some, ground colour orange ; nodal index higher, 14 postnodal to hindwings, 12 to the fore ; pterostigma yellow, black, proximad, broader, over 3 to 5 cells.

Distribution. Confined to the Nicobars. Type in the Selysian coll.

Micromerus andamanensis, Fras. Rec. Ind. Mus., vol. xxvi, p. 410 (1924).

Male. (Female unknown,) Abdomen 16 mm. Hindwing 20 mm.

Head. Eyes bluish grey ; labium and labrum black ; rest of head jet black with the following citron yellow markings ;—two narrow oval spots at base of epistome above, a large oval spot on the outer side of each posterior ocellus, a similar postocular spot on each side, and a linear spot on the hinder border of occiput.

Prothorax black with a large yellow spot on each side.

Thorax black marked with golden greenish yellow as follows, two small spots on the antealar sinus, a fine carinal dorsal line, two fine antehumeral stripes incomplete above, an oblique linear spot on each side of the antealar sinus. Laterally two irregular spots lying between the lateral sutures, the anterior golden yellow, the posterior distinctly greenish, and a broad stripe occupying the upper anterior three-fourths on the metepimeron.

Legs black, the hinder tibiæ pulverulent white on the flexor surface. Wings hyaline, faintly amber tinted at bases, forewings broadly tipped with black to 4 mm. in extent and metallic blue by reflected light ; hindwings enfumed at apices ; pterostigma black, only present in hind wings ; 5 to 6 antenodal nervures in all wings.

Abdomen golden yellow marked with black as follows :—Segment 1 narrowly black at base, more broadly at sides ; segment 2 with a broad dorsal stripe expanded at basal and apical ends of segment, also a broad black stripe low down on sides not extending as far as apical border of segment ; segments 3 to 6 with broad middorsal stripes expanded only at apical border of segments where it forms a narrow ring; segment 7 similar but on the sides, the apical black extending forwards nearly as far as base of segment; segments 8 to 10 entirely black.

Anal appendages black, similar to those of *lineatus*.

Distribution. Andamans, the type, a male, is in the Indian Museum, and was taken by the late Dr. Annandale on the Western slopes of Mt. Harriet, November 30, 1923(fluttering over the surface of a pool below a waterfall). Altitude 500 ft. This very beautiful insect is easily distinguished by the broad metallic blue tip to its wings, as well as the extreme grade of melanism as compared to other species of the genus, it is to be hoped that some collector on the spot will find the female for us. It should not be difficult to secure a fine series as most species are usually abundant where taken. The female is probably very similar to *lineatus* and without a black tip to her wings.

Micromerus finalis Selys, Bull. Acad. Belg. (2) xxvii, p. 665 (1869),—Id. *Ibid.*, xxxvi, p. 616 (1873),—Kirb,. Cat. Odon. 115 (1890),—Id. Journ. Linn. Soc. (Zool) vol. xxiv, p. 556 (1894),—Laid., *Spolia zeylanica* vol. xii, part 47, pp. 351–352 (1924).

Male. Abdomen 16 mm. Hindwing 21 mm.

Head. Labium yellow, lobes tipped with black; labrum glossy black, unmarked; epistome metallic blue or violety blue; cheeks with a narrow yellow stripe against the eyes; frons black with a pair of large rectangular spots of citron yellow; vertex black with an oval citron yellow spot on the outer side of each posterior ocellus; occiput black with a rounded postocular spot on each side and a linear spot along the hinder border, narrowly separated from the former.

Prothorax black marked exactly as in *lineatus*, but the anterior of the two lateral fasciæ with a large black spot below. Beneath black marked obscurely with dark yellow areas.

Legs black, all tibiæ pulverulent white on flexor surfaces and all femora pulverulent on same surfaces except for a short distance at the distal extremities.

Wings hyaline palely amber tinted, especially the hinder; forewings tipped with black for about 3 mm., pterostigma absent; hindwing with well-formed elongate pterostigma, covering 3 cells; 6 antenodal nervures in all wings, 10 postnodals in the hind; discoidal cell traversed once in all wings.

Abdomen black marked with bright citron yellow laterally, changing to green or bluish-green on dorsum. Segment 1 with the base narrowly and the sides broadly black; segment 2 with a large angulated subdorsal spot on either side, the black forming a large T-shaped mark on dorsum, base, and sides where the arms of the T turn back; segments 3 to 4 very similar but the head of the T-shaped mark very narrow, as also its lateral prolongations back, and on the sides of the latter segment, the beginnings of a narrow lateral stripe apicad; segment 5 to 7 with subdorsal elongated spots divided, except on segment 5, by a narrow lateral black stripe; segments 8 to 10 unmarked.

Anal appendages black, similar in structure to those of *lineatus*.

(The female has not hitherto been described.)

Female. Abdomen 16 mm. Hindwing 25 mm.

Head black marked with bright yellow ochre as follows —the labium except for the tips of lobes; the labrum except for the base which is narrowly black and the border which is broadly black, and also a triangular prolongation from the middle of the basal black which may be confluent with that of the foreborder. (In very adult specimens, the yellow reduced to two minute points); a pyriform spot on the dorsum of epistome, reduced in adult specimens to a tiny linear mark. (The anterior facet of epistome metallic blue, but more dully so than in male); the bases of mandibles broadly yellow, the basal segments of antennæ, the cheeks, two pairs of spots on frons in front of ocelli, an oval spot on outer side of each hinder ocellus and similar spots on occiput as in male. (In very adult specimens, these spots reduced to mere points, and the median linear spot on hinder border of occiput entirely absent.)

Prothorax black with a linear or top-shaped spot on middorsum of posterior lobe and a large spot on the sides of mid-lobe.

Thorax black marked very much as in the male but the markings more restricted. The antealar sinus with two small yellow spots, the middorsal carina very finely, the humeral stripe either absent or represented by a chain of small

Two views of the River Cauvery, Coorg-Mysore Frontier; favourite haunts of *Micromerus lineatus indica* and *Rhinocypha bisignata*. Other species taken here include *Mesogomphus lineatus*, *Macromia cingulata* and *indica*, *Macromidia donaldi*, *Onychothemis testacea*, *Zygonyz torrida isis*. *Chloroneura apicalis* and *quadrimaculata* were found here also, the former lurking under the bigger trees, the latter perched on bare rocks in mid-stream.

spots, or a tiny linear upper spot ; the lateral fasciæ similar or the anterior one bisected below and completely cut in two at its middle, the upper portion more or less obsolete. Beneath brownish yellow with the sutures diffusely black.

Legs yellowish, black externally, the hinder pair of femora bright yellow except at the distal ends.

Wings palely tinted and enfumed, the hinder pair occasionally tipped narrowly and diffusely with blackish brown ; pterostigma creamy white framed in black and clouded with black proximad ; discoidal cells traversed once or twice ; 7 antenodal nervures to all wings, 11 to 13 postnodals.

Abdomen black marked with bright citron yellow or greenish yellow as follows,—the middorsal carina narrowly from segment 2 to 8 ; segment 1 as for male, segments 2 to 8 with broad lateral stripes constricted subapicad, markedly on segments 2 and 3, less so on 4 to 6, tapered apicad on segment 7 and broadening apicad on segment 8 ; a large round spot replacing this stripe on segment 9, and a smaller spot on segment 10, absent in very adult specimens. A chain of broad yellow spots on ventrum. Vulvar scale robust, shaped as for *lineatus*.

Anal, appendages black, conical, pointed at apices, twice the length of segment 10.

Distribution. Confined to the montane and submontane districts of Ceylon. Col. F. Wall took a fine series at Banderawela and Nalande, the former 5,000 ft., during October, but it probably has a succession of broods throughout the monsoons. I took this species in August at Dyatalava, and Col. Wall and Mr. E. Green at Kandy, 2,000 ft. October–November.

Micromerus greeni, Laid. *Spolia Zeylanica*, vol. xii, part 47, pp. 352–354 (1924).

Male. Abdomen 14 mm. Hindwing 17–19 mm.

Head black marked with bright ochre as follows :—Labium entirely black ; labrum glossy black, unmarked ; epistome black, its anterior facet bluish-violet metallic ; frons with a single pair of spots, less commonly a second pair of very minute points posterior to anterior pair ; an oval spot on the outer side of each hinder ocellus, a rounded postocular spot on each side of occiput and a linear spot along its hinder border, which in some, has a tiny medial point anteriorly ; the cheeks with a narrow yellow bordering against the eyes.

Prothorax black marked with citron yellow as follows :—a narrow anterior collar followed laterally by a small spot and then a large medio-lateral subtriangular spot. A large spot on the dorsum of posterior lobe shaped like the ace-of-clubs, and two smaller spots low down on its sides.

Thorax black marked as for *lineatus* but the markings more reduced as follows,—the humeral stripe present only as a tiny upper linear spot, the antealar sinus with two small rounded spots, the upper part of the anterior lateral fascia tapered away above and shaped like a sickle, the second or hinder fascia framed heavily in black. Beneath black.

Legs black, all tibiæ pulverulent white on flexor surfaces, all femora pulverulent creamy yellow on distal halves of flexor surface.

Wings hyaline palely tinted with yellow, the hind palely enfumed, the apices of forewings tipped with black for about 3 mm. and with a more or less marked metallic lustre at this part ; the hinder with apices clouded with black at extreme border. Pterostigma present only in hindwings, covers 3 to 3½ cells, black. Costa proximad to node, and the nervures behind it, bright blood-red, this colour less marked in the hindwing and darkening proximad. Discoidal cells with one traversing nervure ; 6 antenodal nervures in all wings, 10 to 12 postnodals in hindwings.

Abdomen black marked with bright citron yellow and blood-red as follows,—segment 1 with an apical ring of citron yellow broadening laterally ; segment 2 with a large subdorsal spot not reaching the basal extremity and constricted near its apical end, citron yellow ; segment 3 with a broader spot citron yellow tinged with reddish, extending from base to apex of segment and abruptly narrowed subapicad and, partially divided by a narrow longitudinal black stripe running from its apical end ; segments 4 to 10 with the markings blood- or brick-red, broad paired spots separated by the black dorsal carina, constricted at the apical end and not quite reaching the apex of segments, thus forming rather narrow inverted black capital T-like markings on each segment. Segments 9 and 10 with only a small round apical spot on each side.

Anal appendages black, rather slenderer than in other species, twice as long as segment 10.

(The female has not hitherto been described.)

Female. Abdomen 12 to 13 mm. Hindwing 19 to 20 mm.

Head marked very similarly to the male, differs as follows :—Labrum with a pair of large triangular yellow spots ; epistome with a metallic colouring poorly developed ; two small linear spots on dorsum of epistome, obsolete in very adult specimens ; bordering medial spot on occiput absent.

Prothorax black with a narrow linear medial stripe on dorsum of posterior lobe, a large spot low down on its sides, a large spot on each side of medial lobe and, rarely, a fine anterior collar.

Thorax black marked exactly as for male, but in very adult specimens, with the antero-lateral fascia cut in to two spots at its middle.

Legs black, some slight pruinescence on the flexor surface of femora, and the same surface on anterior pair of tibiæ pulverulent creamy white except at distal ends.

Abdomen black marked with citron yellow, with a greenish tinge on the anterior segments as follows :—Segment 1 with a lateral quadrate spot ; segments 2 to 8 with the middorsal carina finely yellow and with lateral stripes, which are constricted apicad on segments 2 to 5, tappered on 6 and 7, reduced to a spot on the others or, in very adult specimens absent on segments 9 and 10, less often on segment 8 and rarely present on segment 10.

Anal appendages and vulvar scale as for *lineatus*.

Wings hyaline, not enfumed or tinted ; 5 to 6 antenodal nervures, 10 to 12 postnodals in all wings ; discoidal cell traversed once ; pterostigma white framed in black and clouded at its proximal end.

Distribution. Col. F. Wall took a number of these insects at Nalande, Ceylon, during September and October, whilst Mr. E. Green took specimens at Haragama, Peradeniya and Kandy from June to December, so that it appears to have a long season like most species of the genus. It closely resembles *M. aurantiacus*, but the black markings are more extensive. Easily distinguished from all other species by its red abdomen, strongly reminescent of the African Libellagos.

Micromerus aurantiacus, Selys, Bull. Acad. Belg. (2), xvii, p. 448 (1859),—Id. *Ibid.*, (2), xlvii, p. 397 (1879),—Kirby, Cat. Odon., p. 115 (1890),—Laid. *Proc.* Zool. Soc. Lond., p. 331 Sept. (1920),—Will. Proc. U. S. Nat. Mus., vol. xxviii, p. 172, fig. 7 (1904).

Male. Abdomen 12-15 mm. Hindwing 15-16 mm.

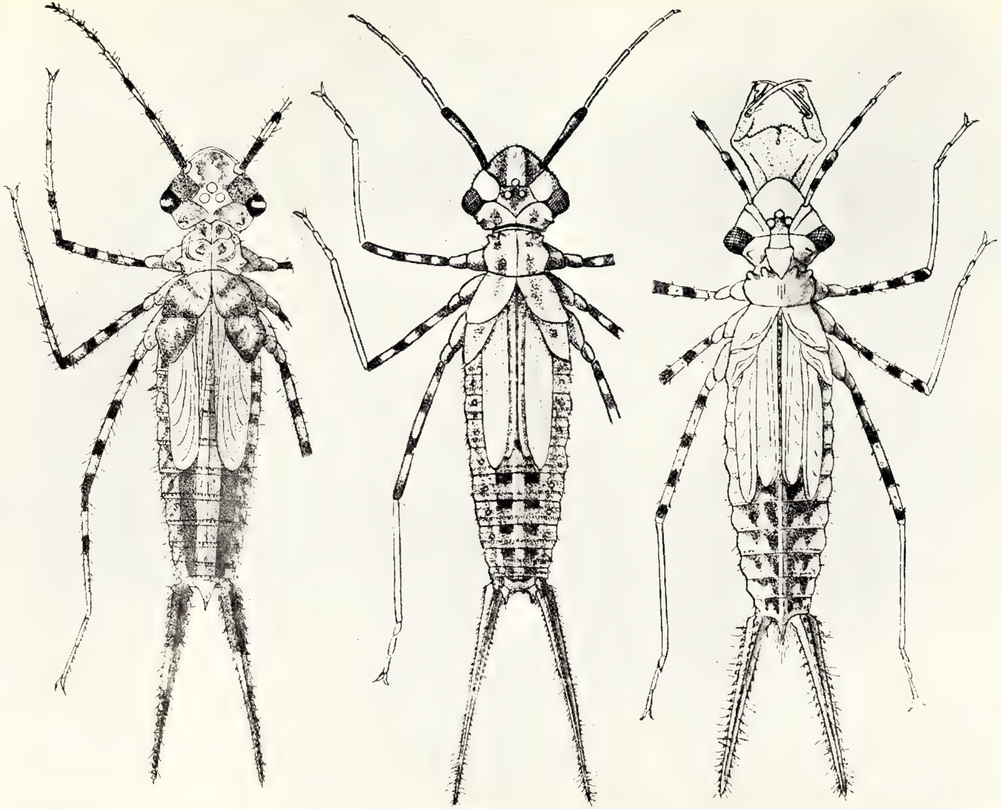
Head black spotted with citron yellow as follows:—A lateral spot on each side of epistome, which latter is metallic blue at its anterior extremity ; two pairs of squarish spots on frons, a rounded spot on the outer side of each hinder ocellus, a postocular rounded spot on each side of occiput and a linear spot on its hinder border. In very adult specimens the latter spot and the hinder pair of the frontal spot absent.

Prothorax black with a small geminate spot on the middorsum of posterior lobe and a large spot on each side of mid-lobe, yellow.

Thorax black marked with citron yellow as follows,—the middorsal carina finely, an antehumeral stripe broadening below, a fine humeral stripe incomplete below or almost obsolete, two small spots on antealar sinus, and two broad fasciæ on the sides of thorax, the anterior of which is bifid below and narrowed and sickle-shaped above.

Wings hyaline, tinted palely with amber at bases, the forewings tipped with black for about 3 mm. and without pterostigma. Costa reddish immediately proximad of node ; hindwing with well-formed pterostigma, black, covers 2 to 3 cells ; discoidal cell traversed once in all wings ; 5 antenodal nervures, 10 postnodal to all wings.

Abdomen bright orange, the articulations narrowly black, as also the ventra border of segments. Segment 2 with an irregular black apical marking, not meeting over dorsum but prolonged obliquely forwards on the sides to fuse with black of ventral border. On segments 3 to 8 a pair of minute black dorsal subapical points ; segment 9 with the latero-ventral border extending on to dorsum especially apicad where it indents the orange ground colour ; segment 10 with its sides and apical border black,



LIBELLAGINE LARVŒ

FIG. 1. Larva of *Rhinocypha ignipennis*, Selys.
,, 2. ,, *Micromerus lineatus indica*, subsp. nov.
,, 3. ,, *Rhinocypha bisignata*, Selys.

Anal appendages black, shaped as for *greeni*, twice the length of segment 10. Inferiors only half the length.

Female unknown.

Distribution. Only a single specimen of this insect has been taken within India limits, this in Mergui, Lower Burma, a male by Mr. Elton Bott, now in the Pusa Museum. It is not uncommon however in Malaysia and thence throughout Southern Asia. Williamson reports it from Trong, Lower Siam, Martin from Tonkin, Laidlaw from Borneo. The markings of the abdomen are very reduced in the Burmese example. The Siamese example has the base and sides of segment 1 black, as also a lateral black stripe on segments 3 to 8, enclosing a basal spot of the ground colour on segments 3 to 5 and incomplete basad on segments 6 to 8. There is also an interrupted black stripe on the sides of segments 2 to 8 in the type from Singapore. Type in Selysian collection.

LIBELLAGINE LARVAE.

Only three larvæ of the *Libellaginæ*, two *Rhinocypha* and one of *Micromerus*, are known. All three agree in everything except minor details so that we may say for certain that those of *Libellago* are not dissimilar.

Very sluggish in habits and cryptic in colouring, they are difficult creatures to find. They cling to roots or broken-up debris in slow-running streams or at the bottoms of pools in swifter running ones. I have found the easiest way to take them is to dredge out a quantity of such debris and spread it on the foreshore of the stream, exposed to the sun. So soon as it has drained and the creatures have begun to feel the heat of their new environment, will they begin to stir from their lethargy, and as a consequence, are at once easily detected.

They possess three spine-like caudal gills, which are undeveloped in the earlier instars. All appear to have banded limbs and most, some cryptic brown markings on the head, thorax and abdomen. The mask is deeply fissured, the edges of the fissure overlapping ; the lateral lobes are cheliform and furnished with a long movable hook. The whole mask is of remarkable length, extending back, when in repose, to the hinder legs.

The gizzard has numerous folds, usually 16 in number, each bearing a row of 4 to 5 teeth. The antennæ long and 8-jointed, the basal one very short, the penultimate of great length.

Autotomy of the caudal gills is accomplished with the greatest ease, so that it is difficult to obtain one with all intact ; probably these are more for defence than for respiratory use, and they certainly carry on quite well without them.

For details of the respective larvæ, the reader is referred to Plate III.

(*To be continued*)

THE STUDY OF PLANT LIFE

BY

CHARLES MCCANN,

Asst. Curator, Bombay Natural History Society

PART I.

(With two Plates and 5 text figures)

The study of plant life, otherwise known as Botany, is very often believed to be one of those 'dry-as-dust' subjects which hold no, or little, interest for the average man and one that is best left to those cynics who find no pleasure in life; in fact, a botanist is very often considered a 'dry-as-dust gentleman.'

Just as we meet different types of people, so there are also different types of botanists for, like other subjects, Botany is divided into many different branches. First comes the Systematist who splits the Vegetable Kingdom up into classes, orders and families and ultimately into genera and species. To this type of Botanist we owe the scientific names, and without him it would be almost impossible to carry on, as classification and the fixing of the species must necessarily form the basis for other phases of botanical work. The Systematist, while he is able to give us the names, may know little of the functions and life of the plants he has examined; this is the department of the Physiologist who endeavours to explain the functions of various plants and their organs in the light of researches made by the Systematist. There are then the Specialists who have an exhaustive knowledge of a single group or genus. Their knowledge is very deep but often narrowed to the limits of their special subjects. Lastly we may refer to the all-round botanist who, although his knowledge may not go so deep as that of the Specialists, in all likelihood gets more pleasure out of the subject as a whole, and is better able to see the wonder and infinite variety of the Vegetable Kingdom and to approach its true position in the general scheme of life on our planet. He will have more ample opportunity of studying plants in their natural environment, noticing their habits, likes or dislikes and their special peculiarities which are as infinitely varied as those manifested in animal life.

The Animal Kingdom, including man with all his achievements, is almost entirely dependent on the Vegetable World for existence.

The existence of plants does not strike us so forcibly as does that of animals, perhaps on account of the absence of locomotion (though locomotion *is* present in the lower microscopic forms of plant life) and other activities similar to those of the Animal World.

From the layman's point of view, one of the drawbacks to the study of botany in India is perhaps that the majority of books available require a fore knowledge of the subject before they can be used to any advantage. It is this drawback that is mainly responsible for the fact that many in search of a hobby set aside botany as a subject without vital interest.

This and the following articles are being written with a view to awaken the interest of my readers to the 'little world' within ours to which we are so deeply indebted, and to lay before them as far as possible, the Little Book of Nature from the reading of which so much interest and pleasure may be derived.

THE CYCLE OF PLANT LIFE.

What is this cycle of plant life and how may we study it? Some regard the Vegetable Kingdom as a dead domain from which we learn but little; but in reality it is a very living one from which an infinite amount of knowledge may be gathered. Each little plant has its own little story to tell of its place in nature. The whole of the Animal Kingdom is dependent on plants either directly or indirectly for its food and to a great extent for the fresh air which is so necessary for its existence. We could go on indefinitely forging the links in that wonderful chain known as the 'Economy of Life', but this would take us beyond the scope of the present article and so only brief reference to these links will be made. In the course of our story I will endeavour to cover the cycle of plant life from the seed to the mature plant and back to the seed, and to reveal the sequence of the life history.

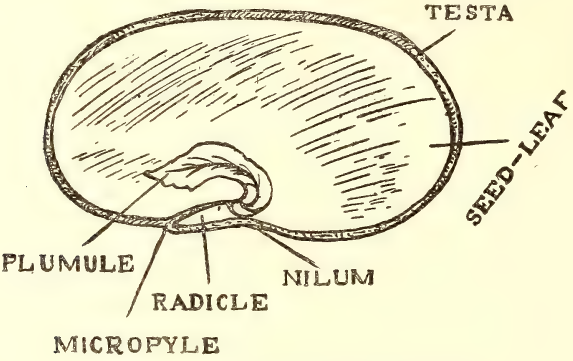
To commence this cycle and to read the wordless story which plants tell us every day of our lives, it would perhaps be best to start from the seed and follow the development of the plant which springs therefrom to the stage where the seed is returned by the plant to earth again. The unanswerable question 'Which came first the egg or the hen'? or in our case, 'the seed or the tree?' might perhaps arise in the mind of my readers, but as this question is just a matter of opinion and conjecture, I leave it to the reader to decide which he would prefer to have first. For my purpose I propose to start from the seed.

THE SEED.

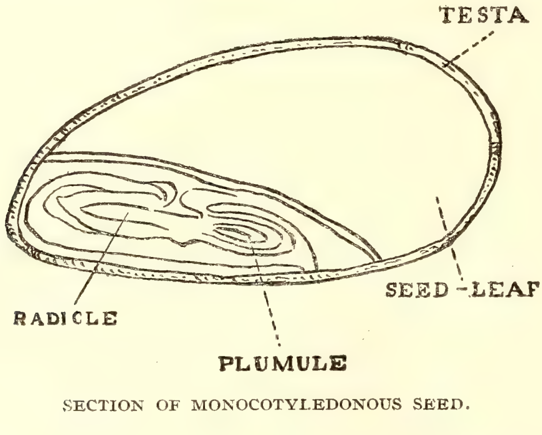
What is a seed? To put it bluntly, a seed is that apparently dead object which when given the requisite amount of moisture, develops and gradually begins to show signs of life—it grows! Where does the life come from? The so called seeds of plants contain the germ (life) which after varied periods of rest (for this they must have) and under favourable conditions spring into life as it were, develop into new individuals, thus carrying on the growth of the species—'pay the debt to their ancestors' as our Hindu friends would say. The periods of rest vary, as I have said, sometimes for many years. Barley and Oats (seeds) last over ten years. Seeds containing oil lose their power of germination very soon because the oil becomes rancid; in Willows, e.g., already after a few days. Some seeds germinate in the fruit, i.e., in some Mangroves

(*Rhizophora*). In the soil some seeds are preserved for one hundred and fifty years. Heldreich has shown that seeds of Silene (Campion) have retained their power of germination from 1500–2000 years.

If we examine a seed carefully either with the unaided eye or preferably with a hand lens, we shall find that it is composed of (1) an outer skin, the **testa** or *seed coat:* (2) the *seed leaf* or leaves or **cotyledons**, which compose the two halves of a seed (taking a pea seed for example); (3) the *germ* or **embryo** which is carefully packed away and protected by the seed leaves. All plants are not entirely dependent on this mode of reproduction, but it is the general one among the flowering plants. It might be mentioned here that the Vegetable Kingdom is divided into two large classes (*a*) the Flowering Plants technically known as the *Phanerogams* ; (*b*) the Non-flowering plants the *Cryptogams*. The last mentioned contain the ferns, mosses, etc. The Flowering Plants are again divided into two, the *Dicotyledons*, those possessing two seed leaves,



SECTION OF DICOTYLEDONOUS SEED.



SECTION OF MONOCOTYLEDONOUS SEED.

such as peas, beans and most of the large trees ; this class possesses perhaps the largest number of orders ; and the *Monocotyledons*, those which have only one seed leaf, such as the Orchids, Lilies, Grasses, etc. Having seen the great divisions into which the plant world is divided, which is not altogether out of place here, we shall return to our story.

As I have said, the production of seed is the general rule but there are some which propagate their species by a process known as ' budding '. The Pine Apple, for instance, propagates its species by producing top and lateral buds which themselves develop into new plants. These buds are fostered by the parent plant till they drop off and are then able to look after themselves. There are other plants again which may be grown from parts of the leaves and cuttings, such as Begonias. The rose is a familiar example of plants derived from cuttings, as the cultivated roses rarely seed. In some plants as soon as a part of the stem or branch reaches the soil, it develops *adventitious roots* (of which we shall see more when we consider the roots of plants) and sooner or later severs all connection with the parent plant to lead an independent life. The violet is a good example of this.

Ferns have no visible ' seeds ', but their place is taken by structures known as ' spores ' which are developed in special organs known as *sporangia* on the under surface of the leaves or fronds or have specially composed organs which bear them. The spores may be easily seen if one examines the underside of the fronds, they form little brown, black or yellowish masses distributed over the underside. In some cases the masses of sporangia are arranged in definite patterns. Mosses develop little pin-head like organs, known as capsules, which contain the spores. It will suffice to say that most of the lower forms of plants bear spores and that there are various types or spore-bearing structures to be met with amongst them.

Having studied the different means of reproduction and propagation to be met with in the Vegetable Kingdom, we shall now consider the development or germination as it is called of a seed and follow up its growth step by step until we reach it again at the top of the tree. Let us suppose that our seed has reached a favourable locality and has received a sufficient supply of moisture. If we watch it closely it will be noticed that it gradually begins to swell up—the first signs of growth in cases of seeds with a thin seed coat —till it bursts. The thin testa or seed coat which has up to now enveloped the cotyledon (seed leaves) casket enclosing the embryo can no longer contain the growing embryo, so it naturally splits at a particular spot (of this spot we shall see more later on). The first evidence of the plant which is emerging from the seed is a tiny white conical structure—the first root, from which the elaborate root system will be developed in the future. It immediately begins to take a downward curve irrespective of the position of the seed before or after germination. One may prove this by a simple experiment with a few beans which have been kept in water overnight or until they germinate. Should the reader however wish to pursue the experiment further, all he need do is to get an empty cigar box and remove one side and substitute a piece of glass sloping from the top inwards (fig. 1). Fill the box with damp saw dust and place a few of the beans in it near the top of the glass in different positions.

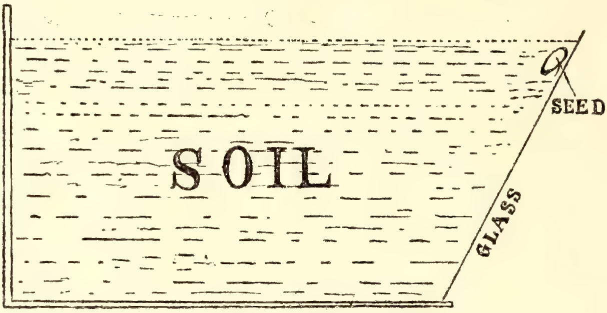


FIG. 1.

Through this glass screen the reader will be able to see the root system as it develops from the germinating seeds, to observe what are known as the root hairs (the functions of which I will explain presently) and also how the roots invariably take a directly downward direction irrespective of the position of their point of emergence from the seed. The tendency of growing vertically downwards is known as *Geotropism*, i.e., growing towards the centre of the earth.

In many instances soon after the root has appeared and attached itself to the substratum, the seed lifts itself above the surface of the soil, casts the testa and unfolds the two halves of which the seed was composed, i.e., the seed leaves or cotyledons. Between them will be seen a minute pair or more of other leaves, beautifully folded, which will develop in course of time. In some cases the seed-leaves remain thick and fleshy, while in others they expand and take the form and colour of ordinary leaves, though generally very different in shape to the leaves that follow. When they first appear above the surface of the soil they are white but as a result of the action of light they become green. The cause of this will be explained when we take up the subject of the leaves. Seed-leaves are heavily charged with reserve food for the young plant and act in the same way as the yolk of an egg. After the leaves have appeared and taken on the duties of supplying part of the necessary food, the seed-leaves shrivel up and fade away, their duties being ended. The vegetative part or shoot always grows upwards or towards the source of light. This tendency which is just the opposite to that of the root, for roots grow away from light, is known as *Heliotropism*, i.e., growing towards the light or sun. A very simple experiment will prove this :—Place a few developed seedlings in an absolutely dark box with a small hole bored somewhere low down on one side to let in light. After a day or two open the box and examine the seedlings and it will be noticed that the plants have changed their direction of growth from the upright towards the source of light. Fig. 2.

As breathing is common to all living things when in an active state (for breathing is almost at a standstill during hibernation), it might be asked, do seeds breathe? The answer is not difficult—though in the case of the seed it may not be considered as breathing in the strict sense of the word. Breathing as is generally understood is an interchange of gases, usually through organs specially adapted for the purpose. Animals give off carbon dioxide (Co_2) and inhale oxygen by day as well as by night, plants on the other hand, while they follow the same process by night, reverse it by day breathing in carbon dioxide and exhaling oxygen. Seeds give off Co_2 especially at the time of germination. There is a tiny aperture at one end of the seed, known as the micropyle through which this breathing, so to speak is carried on. It is here that the radicle or first root breaks through the testa.

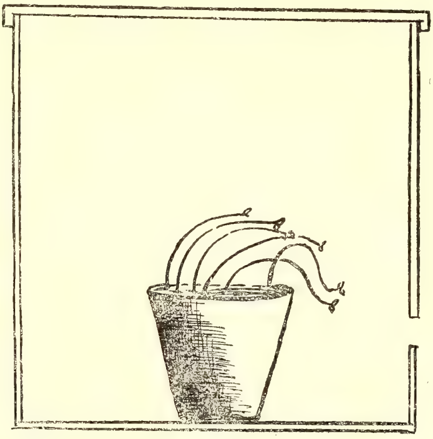


Fig. 2.

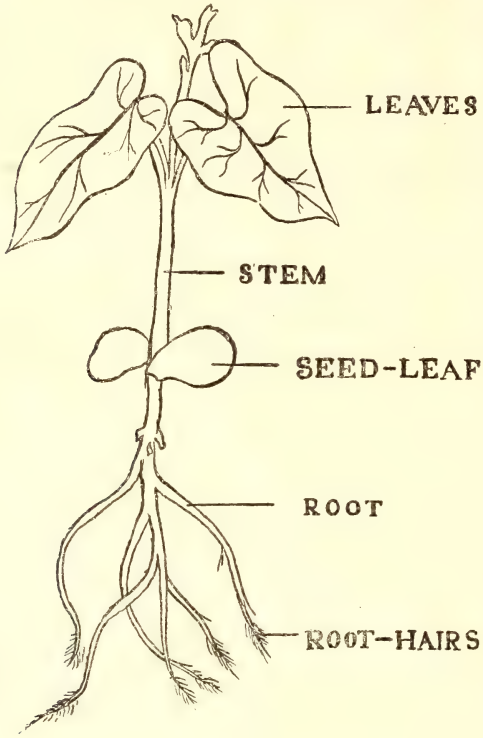
The prompt extinguishing of a lighted taper inserted into a bottle in which germinating seeds have been enclosed, indicates that the seeds have exhausted or breathed in the oxygen contained in the bottle. Similarly the heat, the oppressiveness and the tendency to suffocation on entering a closed room in which grain is stored is due to the breathing of the seed and the accumulation of gases in the room.

The seeds of Monocotyledons, as has been said before, possess only one seed-leaf and this does not as a rule appear above the surface of the soil but nourishes the young plant from where it lies.

Now that we have seen the chief parts of which a seed is composed, viz.: the testa, the seed-leaves and the germ or embryo, and superficially studied its development, we shall proceed to follow up its growth from the root and gradually climb up the tree till we return to it and complete the cycle. The development of the lower types of plants from the spores, we shall consider in a future article.

THE ROOT.

To go on with our story, we commence by carefully examining the first root or radicle which, as I have already indicated, shows itself first and appears as a white or creamy thread-like process which descends into the earth. On appearance it is smooth but it soon develops fine hair-like structures known as the *root-hairs.* Root-hairs do not grow all over the root, but are confined to the growing end. As the root elongates the upper hairs are lost and are replaced by new ones near the growing tip. From the radicle the great root systems of large trees are developed. As the root branches in various directions, the growing extremities of each branch are also clothed with root-hairs. The older parts of the roots become darker in colour and thicker in proportion, assuming a corky covering to protect them. It may be asked, what are the root-hairs and what useful purpose do they serve? Root-hairs are unicellular prolongations which are very essential to the life of every plant: they are the 'procurators,' as it were, of a great quantity of the mineral food and moisture that is necessary to the plant. They go into the microscopic crevices between the particles of soil and take up the available moisture and the particular salts in solution in the soil that are necessary to their growth. They do not absorb all the mineral salts which are present in the soil, but have the power of selection. An acid secretion which exudes from the root-hairs is powerful enough to dissolve such salts as are not soluble in water and to absorb them. At the same time this acid secretion also helps the roots to push their way through hard soil and even rock by disintegrating it, though as a rule the roots follow the line of least resistance.



A SEEDLING OF A BEAN SHOWING THE PARTS OF WHICH IT IS COMPOSED.

The root tip which is the growing part is very delicate and tender and is covered by a special structure the *Root-cap* which protects the growing end on its way through the soil. The root-cap consists of layers of cells which are thickened to form this protecting cover. As the outer layers of this root-cap are destroyed, new layers are being formed on the inside. This root-cap is best displayed by the Palms and especially in the case of the roots of the Screw-pine or *Pandanus* which is fairly common along our shores, from the flower of which the Keora scent is extracted. The part of the root which is protected by the root-cap is devoid of root hairs. The region which is covered by root-hairs is known as the 'root-hair region.' As I have said before the root-hairs secrete an acid. If a piece of polished marble was placed at the bottom of a box in which some beans were allowed to germinate in a covering layer of saw dust, it will be seen after a suitable lapse of time that the growing roots on encountering the resistance of the marble in the downward course have not only spread all over its surface but have left as a result of the acids given out by them, a distinct impression of their outline upon its polished surface.

Not the whole of the root is capable of elongation but the growing part is restricted to about $\frac{1}{16}$th of an inch from the tip. The root tip is sensitive to various stimuli and will react accordingly. Water is the chief attraction and roots may go many yards to obtain it. When water is deep below the surface of the soil, roots will go down deep but when it is near the surface they spread out near the surface. The root systems in plants vary according to the amount of moisture required and are very often governed by the position of the leaves. In some plants the leaves are so arranged that when the rain water or dew falls on them it is directed towards the stem and thence to the roots. In such cases the root system is restricted to a very small area and very often consists of only a tap root or main root. Good examples of these plants are Cannas, Lilies, etc., which require a good supply of water at their particular seasons. In others the branches are spread out and the moisture falls to the ground from the tips of the leaves ; the moisture is thus spread over a greater area. Naturally the root system of these plants is in proportion to the crown. Most of the large trees are good examples of this type of root system.

We have examined the root hairs and root cap ; let us now have a glance at the older portions of the root which were left behind by the growing ends and have had time to enlarge. These parts have long since lost their root hairs and thus no longer have the power of absorption. Nevertheless they still continue to grow but not in length. At first they become discoloured and put on an outer layer of protective armour—cork—which is secreted by the outer cells and which gradually becomes thicker in order to protect the internal 'channels' which convey the sap[1] from the root hairs through the stem to the leaves. They also increase in girth and become more and more rigid to be able to support the tree. What purpose do roots serve ? Besides being the ducts through which the soluble food and moisture is passed on to the stem and leaves they serve the purpose of anchorage—of keeping the tree upright and preventing it from being blown down by winds and storms to which it will be subject in the future. These are the two main functions of the root, but they are not all. They are also used as ' store-houses ' for surplus food and moisture which is accumulated during a favourable season and enables the plant to endure through the long periods of draught or to serve it through its periods of rest—that is to say that they come up during one season, flower, fruit and accumulate reserve material and then die down again to the surface, of the ground only to reappear next season. Accordingly plants are classified into different groups. Plants which develop very rapidly during a favourable season from seed and die down completely after producing seed are known as

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[1] The word ' sap ' is used here in its generally accepted meaning.

Annuals—living but one season. Plants whose life is prolonged beyond a single year or over an indefinite number of years are called Perennials. We know now that roots perform the chief functions, (1) of procurators of food, (2) of anchorage, (3) of store-houses and reservoirs. A brief survey of different types of roots to be met with and the varied shapes they assume according to the requirements of a particular species, will not be out of place here.

Among plants belonging to the Dicotyledons, the radicle or tap root grows and gives off branches and these branch again in turn; with the Monocotyledons, on the other hand, the radicle is short-lived. Roots that appear from other parts of the plant and are known as adventitious roots. These are slender and thread like and are spoken of as *fibrous* roots.

We find this type of root most common among all the Monocotyledons, such as Grasses, Lilies, etc. Adventitious roots are also to be met with among the Dicotyledons of which the Banyan (*Ficus bengalensis*) and others are good instances.

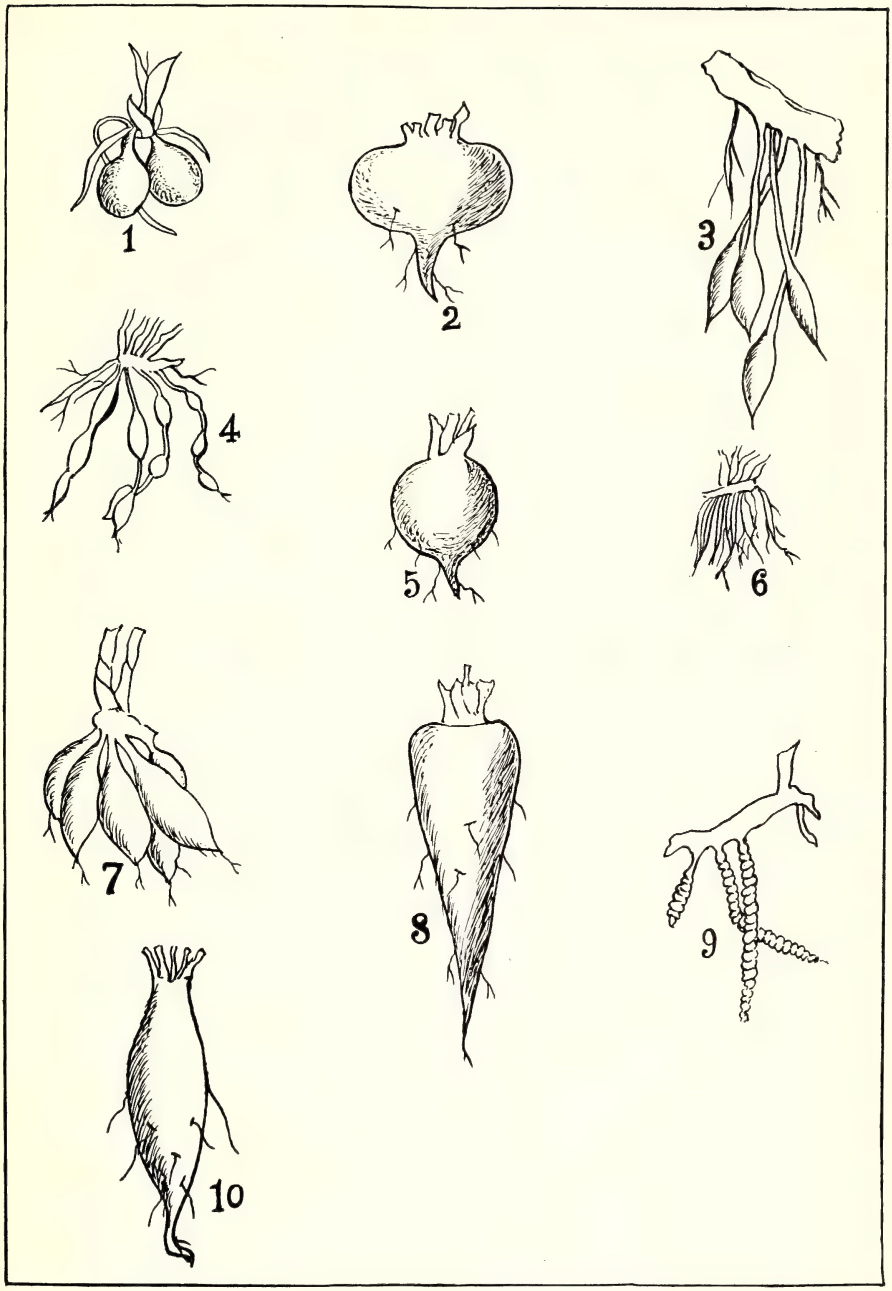
As we have seen, roots may act as a store-house and in consequence assume enormous proportions and various shapes. Thus we have roots whose names are descriptive of their shape. The Carrot is a good example of a *conical* root serving the purpose of storage, the Beet assumes a *spindle shape*, while the Raddish is either *conical* or *globular*. Dahlias have swollen or *tuberous* roots. These are a few examples among many which might be indicated here. All these queer shapes originate from fibrous roots. Care must be exercised however not to confound tuberous roots with a *tuber*, for example the common potato, which is a fleshy underground stem and not a root at all.

An iodine test will show that such roots contain a high percentage of starch, as iodine stains starch a bluish-purple. Beet contains cane-sugar, while the roots of the Dahlia contain inulin. The value of these roots to the Animal Kingdom and man in particular is readily apparent.

As a protection against the depredations of field-mice, insect larvæ and other underground animals, many food-storing roots develop poisonous and nasty substances in their tissues, in the way of noxious alkaloids, foetid gum, resins and other products well known to druggists; it has been observed that such roots are very seldom attacked.

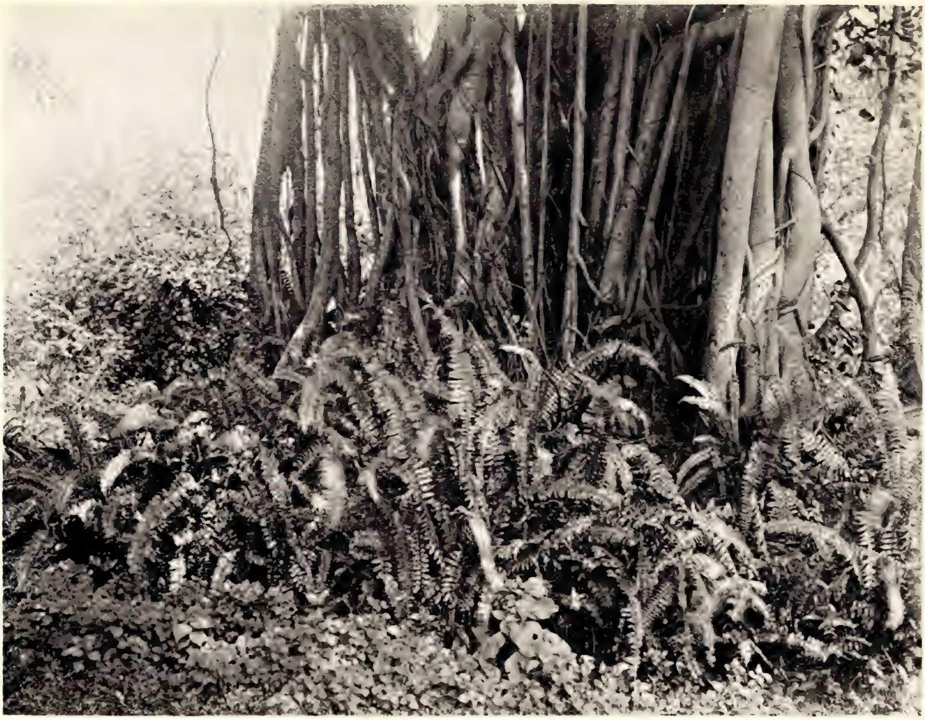
Frequently plants produce more than one type of root, serving different purposes, some being fibrous, absorbing roots, others swollen and charged with reserve food. Some roots after greatly elongating, contract and pull the stem lower down into the soil, such as the Lilies and other familiar plants which have no apparent stem but grow with their leaves in rosettes adpressed to the ground.

Roots often go to a very great depth into the soil, much deeper than people imagine, especially in hard and dry subsoil, in the quest for water. Even in rich garden soil the roots of wheat have been traced to a perpendicular depth of five or six feet. This is however trifling when compared with the depth to which the tap-root of a Baobab-tree (*Adansonia digitata*) descends. Anderson in his account

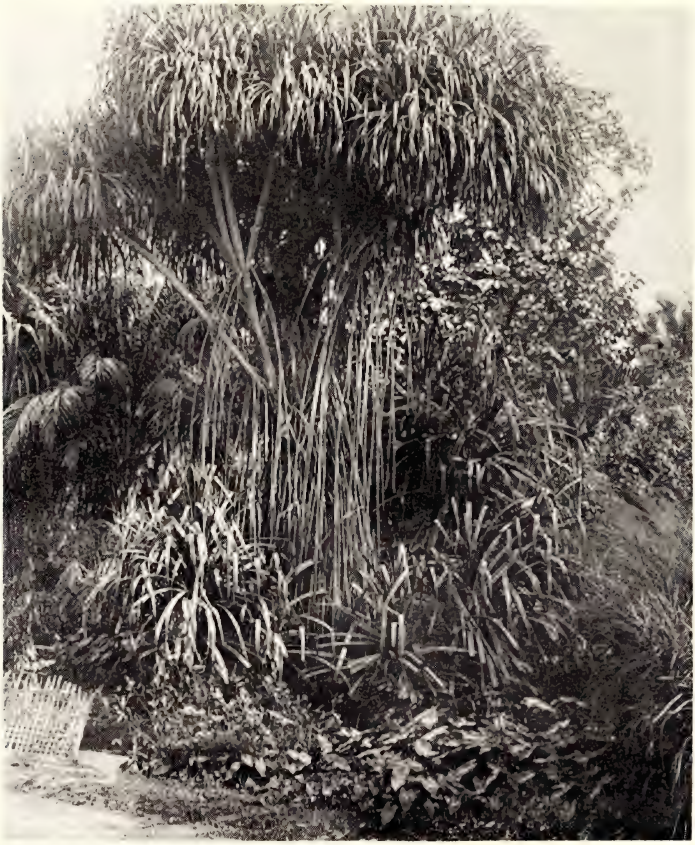


Different Types of Roots

1. Testicular root.
2. Napiform root.
3. Nodulose root.
4. Moniliform root.
5. Globular root.
6. Fibrous roots.
7. Tuberous facicular root.
8. Thickened Tap-root.
9. Annulated roots.
10. Fusiform root.



Aërial Adventitious Roots of the Banyan (*Ficus bengalensis*).



Another type of Adventitious Root. The 'Screw Pine' (*Pandanus Sp.*)

of Senegal, records the root of one of these trees to have reached a depth of one hundred and ten feet.

Then there are what are known as *aerial* roots. These are exemplified by most of the *epiphytic* orchids, i.e., growing on trees but not obtaining their nourishment from them. There are other plants which have aerial roots such as the Banyan, already referred to and also the Pandanus, but these answer mainly the purpose of support.

The roots of many orchids are *feeding* aerial roots. They are modified for absorption of nutriment from the surrounding atmosphere ; in some cases the orchids have no leaves, the roots obtaining for the plant all that is requisite for its nourishment and support. The roots hang downwards like white-threads or cords, the whiteness being due to a papery membrane which covers the green chlorophyll-containing cells of the true root. The envelope consists of perforated cells and acts like a sponge. When they come into contact with water they absorb it immediately until they fill out. The inner living green cells are thus surrounded by a fluid envelope and are able to obtain from it as much moisture as they need. Besides, this sponge tissue has the power of condensing aqueous vapours and other gases, so that the plant is entirely independent of its host for nourishment. Trees growing in marshy ground also send up aerial roots in order to obtain oxygen which is absent in the water-logged soil. Familiar examples of these roots are to be met with in the different species of mangroves which are so common along the marshy shores of the Islands of Bombay and Salsette.

Some large trees develop large root-expansions as additional supports and these are known as *buttress* roots. These roots stand out like great wings round the base of the tree and their development is so enormous at times that a man standing between two of these buttresses would be effectively screened.

The roots of some aquatic plants dangle in the water from which they derive their nourishment, while others contain large air-spaces which aid the plant to float.

Roots possess one almost constant character and that is, that they produce members like themselves, i.e. root-branches, while the stems produce dissimilar members—leaves. However, it frequently occurs that roots give rise to leafy shoots—at times a boon to gardeners and at others a curse, especially in the case of weeds. It often happens that the seemingly complete eradication of weeds in a garden is followed after a few days by fresh outcrops and the area that was apparently cleared is covered with weeds again much to the disgust of the gardener. The reason for this is that part of the roots were left behind in the soil and having the power to send up shoots have covered the ground once more. These shoots are known as *adventitious shoots* or *suckers.*

There still remains one type of root, i.e., the roots of parasitic plants. These plants are entirely dependent on their host for their nourishment and send their roots into the food-canals of the branches or roots of their host and suck them dry. A good example of this is the *Loranthus*, a near relative of the Mistletoe *(Viscum album)* which is commonly to be seen in great clusters on mango trees and others. This plant supplies us with an extremely interesting example of the motility of young roots. The fruit contains birdlime—a peculiar viscous, tenacious and elastic substance—and when the berry falls away it adheres to whatever it falls upon. The seed is embedded in the viscid pulp and germinates commencing in the following way. 'The radicle,' says Mr. N. E. Brown, 'at first grows out, and when it has grown to about an inch in length, it develops upon its extremity a flattened disc; the radicle then curves about until the disc is applied to any object that is near at hand. If the spot to which the disc has fastened is suitable, the germination continues and no locomotion takes place; but if the spot should not be a favourable one, the germinating embryo has the power of changing its position. This is accomplished by the adhesive radicle raising the seed and advancing it to another spot, or to make the purpose plainer, the disc at the end of the radicle adheres very tightly to whatever it is applied to; the radicle itself straightens and tears away the viscid berry from whatever it has adhered to and raises it in the air. The radicle then again curves and the berry is carried by it to another spot, where it adheres again. This disc then releases itself, and by the curving about of the radicle is advanced to another spot, where it again fixes itself. This, Dr. Watt says, has been repeated several times, so that to a certain extent the young embryo, still within the seed, moves about. It seems to select certain places in preference to others, particularly leaves. The berries on falling are almost certain to alight upon leaves, and although many germinate there: they have been observed to move from the leaves to the stem, and finally fasten there. (Gardener's *Chronicle*, 1881).

It might have been better perhaps if we had considered the *sap* of plants at an earlier stage, but before we leave the roots we must elaborate a little more on their functions as procurators of part of the food of plants. *Sap* is the fluid which the roots absorb from the soil or the leaves from the air and which contains in solution the true nutritive principles. Water is the main substance of the sap. It has been estimated that for every two hundred grains of water absorbed and exhaled by a plant only one grain of inorganic matter has been taken up and for every 2000 grains of water consumed one grain of inorganic substance has been appropriated. Young and growing parts of plants are well supplied with sap which fills up every available space in the plant-tissues which is not already occupied by other substances. It is conveyed into the plant by the root hairs, and does not undergo any marked change till it reaches the leaves. Sap may be acid or sweet, clear or turbid, nutritious or otherwise so that its value from an economic point of view is considerable. The acid taste of most unripe fruit is due to the sap. Citric acid, the most common form is found in the juice of lemons, oranges and many of the commonest fruits, and it often exists together with other acids, such as malic acid in the gooseberry, currant and several others. The latter acid is found alone in apples and pears. It is due to the action of these acids that knives are stained when used on various fruit. It is perhaps due to the presence of these acids that young fruit are protected from the attacks of birds and animals which feed on the ripe fruit which is one of the factors in seed dispersal. Birds and animals which eat the ripe fruit containing the fully developed seeds often pass them out in their excreta sometimes miles from the place where they were eaten. The seeds are usually undigested and thus help nature in the dispersal of seed and the propagation of the species in other localities.

In some cases the acid juices of plants destroy or deaden one's sense of taste if masticated, and this state may often last for hours according to the quantity eaten. In some cases sugar tastes like sand in the mouth after taking some of these plant acids by chewing the leaves, flowers or seeds. A sweet orange under the same conditions will taste sour ; the citric acid alone remains distinguishable ; sweet and bitter tastes being destroyed. After a good dose of the leaf of a tropical Asclepiad known as *Gymnema sylvestre*, quinine tastes like chalk.

The sweetness of the sap of the Beet-root is due to the presence of *canose* or cane-sugar dissolved in it. It was first discovered by a Prussian chemist named Margraff (about 1747), but it was not till 1809 when Napoleon forbade the importation of cane-sugar into France from the West Indies, that the discovery was turned to practical account. An Imperial sugar factory was then established at Rambouillet ; pupils were instructed in the process, premiums were offered for the best samples of the sweetener, and in the course of a few years the manufacture of beet-sugar was prosperously set on foot.

Cane-sugar is abundantly found in sugar-cane and the sugar-maple. It is also found in the nectaries or honey-secreting glands of flowers where it furnishes the substance from which the bees gather their honey.

It is secreted by the nectaries and the quantity is at its fullest during the emission of the pollen but stops soon after fertilization of the flower.

A careful distinction must be made between cane-sugar and grape-sugar or *glucose.* These are differently produced by the plant and when treated with the reagent known as Fehling's solution react differently—glucose gives a bulky yellow deposit which canose does not.

Besides these juices there are the milky ones exuded by many plants especially the milkworts (Euphorbias). These milky juices are known as latex. Strange though it may seem, this milky juice is clear while in the uninjured tissues but instantly becomes turbid on exposure to the air. The colour of latex is generally white, but yellow, red and in rare cases blue milk-saps are met with. The microscope shows that it consists of a colourless fluid in which float myriads of minute globules which give the sap its opaque appearance. The common Euphorbia (often erroneously called Cactus) frequently used as a hedging, is a good example of this type of plant. India rubber which is obtained from a tropical American tree (*Hevea brasiliensis*) and other trees, and opium from the opium Poppy (*Papaver somniferum*) are dried juices of such plants.

(To be continued.)

NOTES AND DESCRIPTIONS OF FISHES FROM CEYLON

BY

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(*With 2 Plates*)

The collection reported below was purchased by the Academy of Natural Sciences of Philadelphia in 1924 fron Dr. F. Hallberg, of Göteborg, Sweden. All were obtained at Colombo. Several of the species are of special interest and one appears to be new to science.

ENGRAULIDÆ

Engraulis commersonii (Lacépède)

Depth $4\frac{4}{5}$; head 4, width $2\frac{1}{5}$. Snout $4\frac{1}{2}$ in head ; eye $3\frac{3}{4}$, covered with adipose membrane, greater than snout or interorbital ; maxillary reaches gill opening, $1\frac{1}{8}$ in head ; row of fine teeth on each maxillary and narrow bands on vomer and palatines ; interorbital 4, slightly convex. Gill rakers 19 + 21, lanceolate, greater than gill filaments or $1\frac{2}{3}$ in eye. Scales very caducous, mostly fallen, 33 (pockets) in lateral series from shoulder to caudal base, 9 transversely, 21 ? predorsal : vertical striæ 7 ; pectoral axillary scale $\frac{2}{3}$ of fin, ventral scale $\frac{7}{8}$; no abdominal scutes ; venulose area at shoulder moderate. Dorsal iii, II, i inserted little nearer caudal base than front eye edge, third simple ray $1\frac{3}{5}$ in head ; Anal iii, 17, i, inserted opposite last $\frac{2}{5}$ in length of depressed dorsal, first branched ray $1\frac{9}{10}$; caudal $3\frac{3}{4}$ in combined head and body, forked ; least depth of caudal peduncle half its length or $2\frac{2}{5}$ in head ; pectoral $1\frac{1}{2}$; ventral 2. Largely pale brown. Faint silvery lateral band, less than eye in width, widest on caudal peduncle. Iris pale slate. Dorsal and caudal gray, other fins whitish.

One 110 mm.

TACHYSURIDÆ

Hemipimelodus dussumieri (Valenciennes)

Depth $5\frac{1}{3}$; head 4, width $1\frac{1}{6}$. Snout $3\frac{1}{5}$ in head ; eye 4, $1\frac{1}{5}$ in snout, $1\frac{4}{5}$ in interorbital ; mouth width $2\frac{1}{10}$ in head ; band of villiform teeth in each jaw, palate and tongue edentulous ; maxillary barbel reaches $\frac{3}{5}$ in pectoral spine, outer mental $\frac{1}{4}$ in pectoral spine, inner mental barbel not quite to pectoral spine ; internasal space slightly less than interorbital, nostrils large, front one close to edge of snout and posterior about midway in snout as seen in profile ; interorbital $2\frac{3}{4}$ in head, slightly convex ; occipital fontanel broad, reaches to base of occipital bony plate, which about over gill opening ; occipital buckler with median ridge, wide as long, long as snout. Gill opening with slight median notch, free from isthmus. Dorsal I, 6, spine adipose like for greater portion terminally, equals head ; adipose fin large, slightly over half of head length ; Anal v, II, first branched ray $1\frac{3}{4}$; caudal 1, forked ; least depth of caudal peduncle $2\frac{1}{5}$ in its length or $3\frac{1}{5}$ in head ; pectoral $1\frac{1}{5}$, spine slightly over half length of fin ; ventral $1\frac{4}{5}$. Back and head above pale gray brown, below whitish. Snout, occipital fontanel and under surface of head whitish. Iris leaden gray. Barbels dusky, pale basally. Fins all pale or whitish, upper front edge of spinous dorsal or dorsal spine dusky. Caudal with gray terminally.

One 47 mm. Evidently the young of this species, which changes considerably in proportions with age.

HEMIRAMPHIDÆ

Hemiramphus neglectus Bleeker

Depth $8\frac{1}{2}$ from upper jaw tip, body subcylindrical; head $4\frac{2}{5}$, width 3. Snout 2 in rest of head, free portion little broader than long, width in snout to eye $1\frac{1}{3}$; eye 3 in head from snout tip, $1\frac{1}{8}$ in snout, slightly greater than interorbital; mouth cleft $\frac{2}{5}$ to eye, lower jaw before snout tip 4 to caudal base; maxillary $\frac{4}{5}$ to eye, vertical expansion slightly less than pupil, length $3\frac{3}{4}$ in head from upper jaw tip; interorbital $3\frac{1}{2}$, slightly depressed; postorbital $\frac{3}{4}$ of eye. Gill rakers 9 + 19, lanceolate, equal gill filaments or 3 in eye. Scales 47 from above gill opening to caudal base and 3 ? more on latter, predorsal 40 ? ; all little adherent, most having fallen; basal radiating striæ 3, circuli moderately small. Dorsal I, 13, first branched ray $2\frac{1}{4}$ in head from snout tip; Anal I, 13, first branched ray 3; caudal I, moderately forked or emarginate, lower lobe longer; least depth of caudal peduncle $1\frac{1}{4}$ its length or $4\frac{1}{4}$ in head; pectoral $1\frac{1}{3}$; ventral $2\frac{1}{2}$, inserted little nearer head than caudal base. Faded pale brownish, largely uniform. Predorsal with 3 median close set parallel dusky lines. Narrow dusky band from over gill opening to caudal base, nearly wide as pupil on tail aboveanal, its lower edge with darker bordering line. Snout above and occiput with close set dusky to blackish dots. Beak blackish-brown, continued back along each side of mandible as blackish brown streak nearly to eye. Iris slaty. Fins all pale. Dorsal and anal tinted with gray brown.

One 135 mm. Also one for comparison from Padang, Sumatra, 136 mm. It differs in Depth $8\frac{1}{3}$; head $4\frac{1}{2}$; snout $2\frac{2}{3}$; eye $3\frac{9}{10}$; interorbital 4; gill rakers 6 + 11; Dorsal II, 13; Anal II, 15.

Certainly very close to *Hemiramphus unifasciatus* (Ranzani) from the Tropical Atlantic. Comparison with examples of this latter from Porto Rico shows the American form with a shorter preorbital, which also a little wider than long.

Zenarchopterus dispar (Valenciennes)

Depth $7\frac{1}{2}$ from upper jaw tip, body slightly compressed; head $3\frac{7}{8}$, width $2\frac{4}{5}$. Snout $1\frac{9}{10}$ in rest of head, free upper portion broader than long, width in snout to eye $1\frac{2}{5}$; eye 4 in head from snout tip, $1\frac{1}{2}$ in snout, $1\frac{1}{6}$ in interorbital; mouth cleft $\frac{3}{5}$ to eye, lower jaw before snout tip $2\frac{1}{2}$ to caudal base; maxillary largely concealed, $\frac{4}{5}$ to eye, nearly vertical, expansion $\frac{3}{4}$ of pupil, length 3 in head from snout tip; interorbital 3, level. Gill rakers 6 + 12, lanceolate, long as gill filaments or $3\frac{3}{4}$ in eye. Scales 42 in lateral series from above gill opening to caudal base and 3 more on latter, 4 above lateral line, 2 below, 38 predorsal; few basal scales at front of anal; 5 or 6 basal radiating striæ marginally and circuli fine. Dorsal 12, first ray $3\frac{1}{5}$ in head from upper jaw tip; anal I, 8, first branched ray $2\frac{1}{3}$; caudal $1\frac{1}{6}$, truncate; least depth of caudal peduncle $1\frac{2}{3}$ in its length or 4 in head from snout tip; pectoral $1\frac{2}{5}$; ventral $3\frac{2}{5}$. Back brown, with median dusky line on predorsal. Underlaid gray brown line from shoulder to caudal, greatest width about $\frac{3}{5}$ of pupil along side of tail. Beak blackish. Snout dusky. Iris slate. Vertical fins grayish, more or less dusky terminally. Paired fins pale.

One 150 mm.

Cypselurus hallbergi, new species

(*Plate I*)

Depth $5\frac{1}{4}$; head $4\frac{1}{3}$, width $1\frac{3}{5}$. Snout $3\frac{1}{2}$ in head from snout tip; eye $3\frac{1}{2}$, with free lids, $1\frac{1}{5}$ in interorbital; maxillary concealed, $\frac{4}{5}$ to eye, equals snout; teeth minute, sparse, form slight band in each jaw, none on palate or tongue; interorbital $2\frac{1}{3}$ in head, very slightly concave. Gill rakers 7 + 21, lanceolate, equals gill filaments or $1\frac{7}{8}$ in eye. Scales slightly adherent, rather well exposed; 47 between gill opening above and caudal base and 3 more on latter; 8 above lateral line, 3 below to anal origin; predorsal 30, extending forward little before nostril; 5 or 6 basal radiating striæ, edge lobate and circuli finely concentric. Lateral line not reaching caudal or not extending beyond tip of last anal ray; tubes slender, simple. Dorsal I, II, I, first ray $2\frac{1}{4}$ in total head length; Anal I, 9, I, first branched ray $3\frac{1}{8}$, fin inserted opposite base of second branched dorsal ray; caudal widely forked, upper lobe $1\frac{1}{3}$ in that of lower which $3\frac{1}{4}$ in combined head and body; least depth of caudal peduncle $1\frac{2}{5}$ or 3 in head ; pectoral not quite reaching caudal base, $1\frac{1}{2}$ in combined head and body, rays iv, 13 ; ventral **I**, 5, spine nearly third of fin which reaches back far as pectoral (right fin shorter), length $2\frac{4}{5}$ in combined head and body, its insertion midway between hind eye edge and caudal base. Back deep brown, lower sides and under surface whitish. Iris slate. Lower jaw pale. Dorsal and caudal pale brown. Anal whitish. Pectoral neutral brown medially, terminally dusky, pale basally and lower basal margin whitish. Ventral neutral brown medially and terminally, with broad inner whitish border, base and spine also pale.

One example, the type, 195 mm. (lower caudal tip damaged so estimated at 207 mm.). Differs from all the species of the genus I have examined in the increased rudimentary or simple rays in the pectoral and also in the increased gill rakers. Apparently resembles *Cypselurus simus* (Valenciennes), but unlike any I have seen in the above respects. It is also suggestive or *Cypselurus oxycephalus* (Bleeker), but that species falls within the subgenus *Exonautes* as the anal origin is opposite that of the dorsal.

I take pleasure in dedicating this species to Dr. F. Hallberg who collected the type.

ANABANTIDÆ

Anabas testudineus (Bloch)

One 70 mm. Small dark spot on opercular flap, less than pupil. Caudal base with small vertical brown bar.

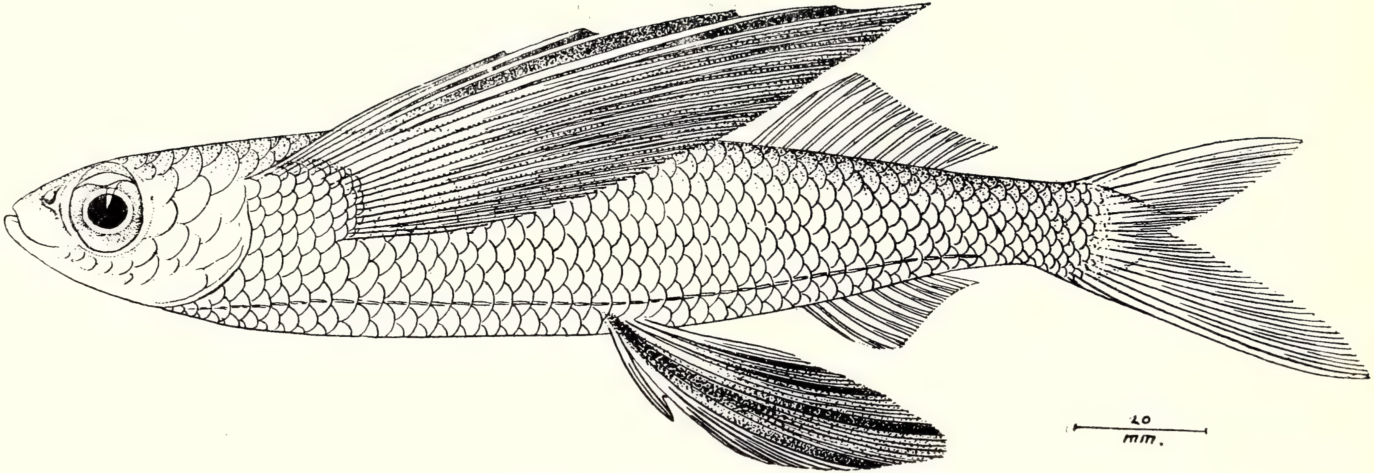
ATHERINIDÆ

Atherina duodecimalis, Valenciennes

(*Plate II*)

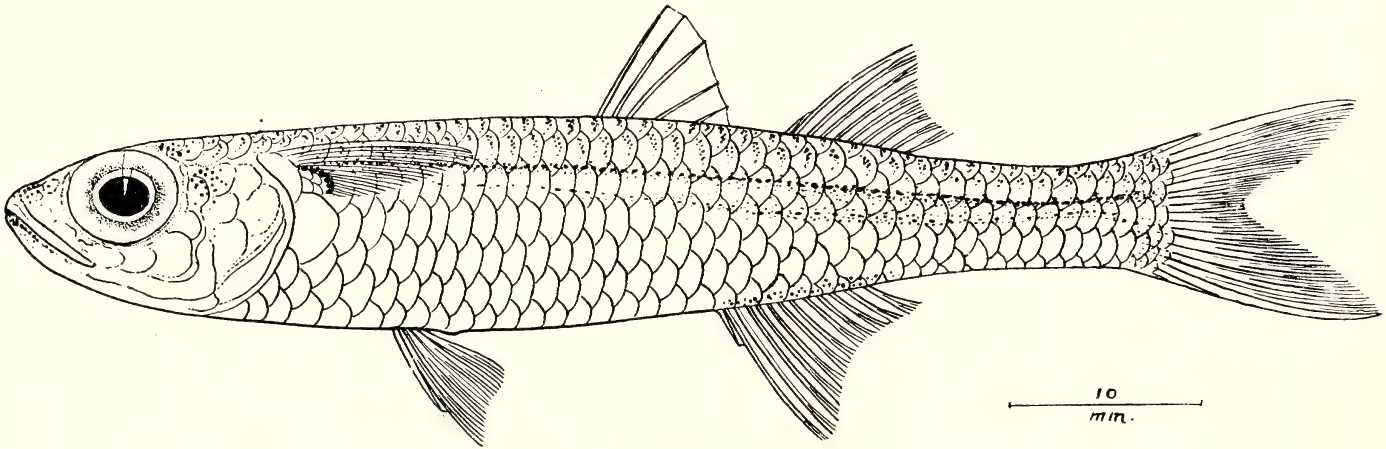
Depth $5\frac{2}{5}$; head $3\frac{3}{4}$, width $1\frac{3}{4}$. Snout $3\frac{4}{5}$ in head from snout tip ; eye $2\frac{1}{2}$, greater than snout or interorbital ; maxillary reaches first fifth in eye, $2\frac{2}{3}$ in head ; teeth small, conic, in bands in jaws, on vomer and palatines ; mandibular rami moderately elevated inside mouth ; interorbital broadly concave, $2\frac{1}{2}$ in head. Gill rakers 5 + 21, lanceolate, slender, $2\frac{2}{3}$ in eye. Scales 38 from above gill opening to caudal base and 4 more on latter, 7 transversely, 16 predorsal, 5 behind depressed spinous dorsal ; single row of scales on cheek ; large scale below pectoral base nearly large as eye ; scales with 3 basal marginal points and 30 basal, vertical, parallel striæ, apical region smooth and with 18 small inconspicuous marginal lobes. Dorsal **V—I**, 10, i, second spine $2\frac{1}{3}$ in total head length, first branched ray $1\frac{3}{5}$ and spine of soft fin short or $\frac{1}{3}$ of first ray ; spinous dorsal origin midway between eye center and caudal base ; anal base about equals its distance from caudal ; Anal **I**, 12, first branched ray $1\frac{3}{5}$ and spine $\frac{1}{4}$ its length ; caudal equals head, well forked, lower lobe little longer ; least depth of caudal peduncle $3\frac{1}{8}$; pectoral $1\frac{1}{6}$; ventral $1\frac{3}{4}$. Uniformly pale brownish, with more or less whitish or silvery. Top of head, end of mandible and snout dusted with dusky brown. Patch of dusky dots on middle of opercle. Each scale of back above with submarginal arc of dusky brown dots. Narrow band of dusky dots along scales at base of anal. Gray band from pectoral axil to caudal base medially, little less in width than pupil at greatest expansion which opposite soft dorsal and anal. Fins all pale, with arc of dusky dots at pectoral base.

One 70 mm. Interest attaches to this specimen as the species was originally described from Ceylon and that it does not appear to have been obtained there since. The type is very briefly described with Dorsal **V—I**, 9 and Anal **I**, 12, its length 76 mm. Bleeker's materials, as given by Weber and Beaufort are apparently the same. It is not a *Hepsetia*, however, as catalogued by Jordan and Hubbs. No previous writer has yet described it completely and as it has not been figured the accompanying drawing is offered. The large infrapectoral scale, the position of the vent at the first $\frac{2}{5}$ of the ventral fins and black in color, will serve to distinguish it from allied species as *Atherina forskali*, Rüppell and *Atherina lacunosa*, Schneider. Ogilby has indicated a large infrapectoral scale for the last named.



Cypselurus hallbergi, New Species.

Henry W. Fowler del.



Atherina duodecimalis, Valenciennes.

Henry W. Fowler del.

MUGILIDÆ

Mugil longimanus, Günther

Depth $3\frac{2}{5}$; head $3\frac{2}{3}$, width $1\frac{3}{4}$. Snout 4; eye $3\frac{3}{5}$, greater than snout, $1\frac{3}{4}$ in interorbital; maxillary concealed, reaches eye, $3\frac{2}{3}$ in head; mandibular angle forms broadly obtuse; lower preorbital edge finely serrate. Scales 31 from above gill opening to caudal base, 12 transversely at soft dorsal, 25 predorsal, 5 behind depressed spinous dorsal; soft dorsal and anal covered with fine scales; axillary pectoral scale $\frac{1}{3}$ of fin; scales with 6 or 7 basal radiating striæ, no apical points. Dorsal **VI**—I, 8, I, first spine $1\frac{3}{4}$ in head, first branched ray $1\frac{4}{5}$; Anal **III**, 9, I, first branched ray $1\frac{3}{5}$ with third spine $\frac{3}{5}$ its length; caudal I, deeply emarginate; caudal peduncle depth $2\frac{1}{5}$; pectoral $1\frac{1}{10}$, reaches little beyond dorsal origin; ventral $1\frac{2}{3}$. Gray brown above, silvery white below. Dorsals, caudal and pectorals with gray brown, last with small diffuse dusky spot at origin. Hind caudal edge dusky. Lower fins whitish. Iris slaty.

One 91 mm.

CARANGIDÆ

Caranx ignobilis (Forskal)

Depth $2\frac{2}{5}$; head $2\frac{9}{10}$, width $2\frac{1}{6}$. Snout $3\frac{2}{5}$ in head from snout tip; eye $3\frac{1}{10}$, with narrow adipose lid behind, subequal with snout or interorbital; maxillary reaches eye center, length $2\frac{1}{6}$ in head; interorbital 4, convex. Gill rakers 6 + 15, lanceolate. Scales 43 + 31, arch $1\frac{2}{5}$ in straight section of lateral line, 14 above, 22 below, scute depth $1\frac{4}{5}$ in eye; breast naked below to ventral, except small patch of small scales posteromedially. Dorsal **I, VIII, I**, 19, I, third spine $2\frac{2}{5}$ in total head length, first branched ray $2\frac{1}{10}$; Anal **II—I**, 16, I, second spine $1\frac{1}{2}$ in eye, first branched ray $2\frac{1}{10}$ in head; caudal $1\frac{1}{3}$, strongly forked; least depth of caudal peduncle $1\frac{4}{5}$; pectoral $1\frac{1}{10}$, reaches fourth scute of lateral line; ventral $2\frac{3}{5}$. Back brownish, below silvery white. Iris slate. Spinous dorsal dusted dusky. Soft dorsal and caudal with pale brownish, other fins whitish.

One 94 mm.

Caranx sexfasciatus. (Quoy and Gaimard)

Depth $2\frac{1}{2}$; head 3, width $2\frac{1}{6}$. Snout $3\frac{1}{3}$ in head from snout tip; eye 4, adipose lid covers last sixth of eye, subequal with snout or interorbital; maxillary reaches opposite eye center, expansion $1\frac{3}{4}$ in eye, length $2\frac{1}{10}$ in head; row of short conic teeth in each jaw and narrow inner band with same, also narrow bands of very small teeth on vomer and palatines and tongue; interorbital 4, convexly elevated; preopercle flange with radiating and marginal venules. Gill rakers 7+15, lanceolate. Scales 43+31, arch $1\frac{2}{5}$ in straight section of lateral line; scute depth $1\frac{7}{8}$ in eye; breast densely scaled. Dorsal **I, VIII, I**, 20, I, fourth spine $2\frac{1}{3}$ in total head length, first branched ray $1\frac{9}{10}$; Anal **II—I**, 16, I, second spine $5\frac{1}{6}$, first branched ray $2\frac{1}{10}$; caudal $1\frac{1}{5}$, strongly forked; least depth of caudal peduncle $6\frac{7}{8}$; pectoral $1\frac{1}{10}$, reaches fourth scute of lateral line; ventral $2\frac{1}{5}$. Back brown, below whitish. Back and sides with 6 or 7 broad obscure darker vertical bands, broader than interspaces. Iris slate. End of mandible brownish. Spinous dorsal neutral dusky. Soft dorsal and caudal with pale dusky marginally, otherwise pale or whitish like other fins.

One 105 mm.

LEIOGNATHIDÆ

Leiognathus splendens (Cuvier)

Three 41 to 51 mm. These agree with Day's figure, though as they are young the back is with large diffuse dull brown blotches. Black blotch including 3 highest membranes of spinous dorsal terminally greatly contrasted. All show a neutral dusky basal line along dorsals. Lower half of body sprinkled with dusky or blackish dots. Iris slate.

CHEILODIPTERIDÆ

Amia endeketænia (Bleeker)

Depth 3; head 3, width $2\frac{1}{2}$. Snout 4 in head from snout tip; eye $3\frac{1}{5}$, greater than snout or interorbital; maxillary reaches opposite eye center, expansion $2\frac{1}{4}$ in eye, length $2\frac{1}{5}$ in head; bands of minute teeth in jaws, on vomer and palatines; interorbital $4\frac{4}{5}$ in head, nearly level; preopercle ridge entire, edge finely serrate. Gill rakers 5 + 15, lanceolate, $2\frac{1}{4}$ in eye. Scales 21 in lateral line to caudal base and 2 more on latter, 2 above, 6 below, 6 predorsal to occiput, 2 rows on cheek; 10 to 13 basal radiating striæ, apical denticles 30 to 32, weak, small, in 3 transverse series and circuli moderate, Dorsal **VI — I**, 9, second spine $1\frac{4}{5}$ in total head length, first ray $1\frac{1}{3}$ with spine of soft dorsal $1\frac{3}{4}$ in first ray; Anal **II**, 8, second spine $2\frac{7}{8}$, first ray $1\frac{2}{3}$; caudal $1\frac{1}{6}$, forked; least depth of caudal peduncle $2\frac{3}{5}$; pectoral $1\frac{3}{5}$; ventral $1\frac{7}{8}$. Faded pale brown generally. Traces of 4 dusky longitudinal narrow bands; second begins on side of snout, crosses eye and postocular, where most distinct. Iris slate. Back and head above with dull brown shades. Fins all more or less pale. Spinous dorsal dusky terminally. Soft dorsal and anal each with diffuse dusky subbasal longitudinal band. Round blackish spot little smaller than pupil at caudal base medianly. Caudal margined above and below with pale dusky.

One 54 mm. It differs a little from Day's figure in that he shows the second dorsal spine but half length of third, whereas in mine the second and third spines are subequal.

AMBASSIDÆ

Ambassis safgha (Forskal)

Depth $2\frac{1}{3}$; head $2\frac{1}{2}$, width $2\frac{4}{5}$. Snout $4\frac{2}{5}$ in head from snout tip; eye 3, greater than snout or interorbital; maxillary reaches opposite front pupil edge, expansion 3 in eye, length $2\frac{1}{2}$ in head: interorbital 5, very slightly convex; preorbital edge entire, lower edge with 7 serræ; lower ridge and edge of preopercle serrate. Gill rakers 9 + 17, lanceolate, slender, $1\frac{4}{5}$ in eye. Scales 30 in incomplete lateral line to caudal base and 3 more on latter, 4 above, 7 below, 22 predorsal, 3 rows on cheek; 1 to 3 basal radiating striæ, no apical denticles and circuli moderate. Dorsal **VII**, **I**, 9, I, second spine $1\frac{1}{3}$ in total head length, first ray $2\frac{1}{4}$; Anal **III**, 9, I, third spine $2\frac{1}{8}$, first ray $1\frac{1}{10}$; caudal $1\frac{1}{10}$, deeply forked, lobes slender and pointed; least depth of caudal peduncle $3\frac{1}{2}$; pectoral $1\frac{1}{5}$; ventral $1\frac{2}{3}$. Uniform pale brown, scales along edge of predorsal and about back posteriorly above with deeper brown dustings. Mandible and upper jaw brownish. Iris slate. Lateral gray line along tail and caudal peduncle medially faint. End of second membrane of spinous dorsal dusky, fins otherwise all pale.

One 88 mm.

Ambassis gymnocephalus (Lacépède)

Depth $2\frac{4}{5}$; head $2\frac{3}{4}$, width $2\frac{2}{5}$. Snout 4 in head from snout tip; eye $3\frac{1}{2}$, greater than snout or interorbital; maxillary reaches first fourth of eye, expansion $3\frac{2}{5}$ in eye, length $2\frac{3}{4}$ in head; interorbital $4\frac{1}{2}$, very slightly convex; preorbital ridge and edge, also lower ridge and edge of preopercle serrate. Gill rakers 8 + 21, lanceolate, slender, $1\frac{3}{5}$ in eye. Scales 11 + 10 in interrupted lateral line to caudal base and 2 more on latter, break below front of soft dorsal. 3 scales above, 6 below, 17 predorsal, 2 rows on cheek; 5 basal radiating striæ, no apical denticles and circuli moderate. Dorsal **VII**, **I**, 9, I, second spine $1\frac{2}{5}$ in total head length, second and third spines subequal, first ray 2; Anal **III**, 9, I, third spine $1\frac{4}{5}$, first ray $1\frac{7}{8}$; caudal I, deeply forked, lobes slender; least depth of caudal peduncle $2\frac{1}{2}$; pectoral $1\frac{1}{3}$; ventral $1\frac{3}{5}$. Uniform pale brownish, scales along edge of back dusted with deeper brown, also jaws dusted brown. Distinct dusky slate line along caudal peduncle and tail medianly each side. Second dorsal membrane blackish. Fine pale. Iris slate.

One 60 mm. *Ambassis urotænia*, described from Delagoa Bay by Fowler[1] is not Bleeker's species, but a younger stage of the present, as it is described with 2 rows of scales on the cheek.

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[1] *Proc. Acad. Nat. Sci. Phila.*, 1925, p. 220.

LUTJANIDÆ

Lutjanus kasmira (Forskal)

Depth $2\frac{2}{3}$; head $2\frac{2}{5}$, width $2\frac{1}{6}$. Snout $3\frac{1}{5}$; eye $3\frac{4}{5}$, $1\frac{1}{10}$ in snout, greater than interorbital; maxillary reaches $\frac{1}{3}$ in eye, expansion $2\frac{1}{5}$ in eye, length $2\frac{1}{3}$ in head; interorbital $4\frac{2}{5}$, little convex; preopercle edge not gashed behind, finely denticulated and denticles larger around angle. Gill rakers 7 + 15, lanceolate. Scales 43 in lateral line to caudal base and 7 more on latter, 7 above, 12 below, 16 predorsal, 5 rows on cheek; 7 or 8 basal radiating striæ, apical denticles 40 to 58, with 6 or 7 series of transverse basal elements and circuli fine. Dorsal **X**, 13, I, fourth spine $2\frac{2}{5}$ in head, first ray $2\frac{3}{5}$; Anal **III**, 8, I, second spine $2\frac{3}{4}$, second ray $2\frac{1}{8}$; caudal $1\frac{1}{4}$, slightly emarginate; least depth of caudal peduncle $3\frac{1}{10}$; pectoral $1\frac{2}{5}$; ventral $1\frac{4}{5}$. Back brown, sides below and under surface paler to whitish. Each row of scales with obscure pale median stripe. Diffuse dusky stripe from snout tip through eye across postorbital. Diffuse blackish blotch size of eye on lateral line below front of soft dorsal. Vertical fins pale brownish, paired fins paler or whitish. Iris slate.

One 84 mm.

THERAPONIDÆ

Therapon jarbua (Forskal)

One 100 mm.

SPARIDÆ

Sparus berda Forskal

One 80 mm. Molars in 3 rather irregular series in each jaw posteriorly. Preorbital with its least width $1\frac{3}{5}$ in eye. Dark blotch at shoulder but little distinct. Dorsal with more or less dusky on membranes terminally.

LETHRINIDÆ

Lethrinus reticulatus, Valenciennes

Depth $2\frac{3}{5}$ to $2\frac{7}{8}$; head $2\frac{2}{3}$ to $2\frac{3}{4}$, width $2\frac{1}{4}$ to $2\frac{2}{5}$. Snout $2\frac{7}{8}$; eye 3, $1\frac{1}{8}$ in snout, greater than interorbital; maxillary not quite or to eye front, 3 in head; interorbital 4 to $4\frac{1}{8}$, slightly convex. Gill rakers 4 + 7, short tubercles. Scales 45 in lateral line to caudal base and 2 more on latter, 6 above, 13 below, 9 predorsal. Dorsal **X**, 9, I, fourth spine $2\frac{2}{5}$ to $2\frac{4}{5}$ in head, first ray $2\frac{2}{5}$ to $2\frac{1}{2}$; Anal **III**, 8, second spine $2\frac{1}{3}$ to $2\frac{4}{5}$, second ray $2\frac{2}{5}$; caudal $1\frac{1}{5}$ to $1\frac{1}{3}$, emarginate; least depth of caudal peduncle 3 to $3\frac{1}{10}$; pectoral $1\frac{1}{8}$ to $1\frac{1}{6}$; ventral $1\frac{1}{2}$. Pale olive gray, slightly paler on under surface. Sides and back with darker and rather large reticulations, mostly with meshes deeper vertically. Iris slate. Postocular more or less dark olive. Variably diffuse dark blotch above pectoral base and another vertically at caudal base. Dorsals and caudal with grayish tints, fins otherwise pale.

Two 68 to 72 mm. These appear to be the young of this species, originally described from an example 102 mm. long obtained in New Guinea. Valenciennes says the head is reddish with 2 or 3 brown bands below the eye. Opercular border yellow. Body paler than head, irregularly blotched with blackish. Soft dorsal, anal and caudal finely streaked with dusky. Bleeker's figure[1] appears to be the same, though it is less variegated than my examples, or without the dark suprapectoral blotch or the basal caudal bar. *Lethrinus mœnsii* Bleeker also appears to be the adult stage. The species ranges from the Seychelles to Oceania.

GERRIDÆ

Gerres lucidus Cuvier

One 70 mm. Snout short, $1\frac{2}{3}$ in large eye, which $2\frac{1}{2}$ in head. Third dorsal spine $1\frac{2}{3}$ in head, second spine but little shorter Though spinous dorsal dusky terminally on 3 highest membranes the usual spots subbasal on membranes above edge of basal scaly sheath are little evident.

SILLAGINIDÆ

Sillago sihama (Forskal)

One 140 mm.

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[1] *Atlas Ichth.*, 8, 1877–78, Pl. 330 (52), Fig. 1.

MONODACTYLIDÆ

Monodactylus argenteus (Linnæus)

One 64 mm. Brown ocular band and narrower brown band from before spinous dorsal down on opercle.

SIGANIDÆ

Siganus javus (Linnæus)

One 62 mm.

Siganus virgatus (Valenciennes)

One 85 mm. This differs largely from Day's figure in that the dark ocular band from the spinous dorsal to the chin is very obsolete, though it has traces of several dark interorbital lines. The head and body are rather coarsely spotted, blotched or vermiculated with deeper brown. Spinous dorsal and anal clouded with deeper brown, though on soft dorsal 3 rows of dusky spots largely on each ray and most distinct basally on fin. On anal largely as 2 dark basal bars. Caudal transversely and diffusely barred with dusky. Pectoral pale. Ventral dusted with dusky.

GOBIIDÆ

Glossogobius biocellatus (Valenciennes.)

Depth $5\frac{1}{5}$; head $2\frac{7}{8}$, width 2. Snout $3\frac{3}{4}$ in head from snout tip ; eye $4\frac{7}{8}$, $1\frac{1}{2}$ in snout ; maxillary reaches nearly opposite hind eye edge, 2 in head ; teeth moderately large, well spaced, in bands in jaws, none on palate ; tongue with deep median notch in front ; interorbital narrow bony frenum, $2\frac{1}{2}$ in eye. Gill rakers 2 + 7, short low rounded tubercles. Scales 30 from over gill opening to caudal base and 3 more on latter ; 8 scales transversely from soft dorsal origin ; 14 predorsal ; 14 to 17 basal radiating striæ, apical denticles 31 + 41 to 32 + 36 and circuli fine. Dorsal **VI—I**, 9, I, fourth spine $2\frac{1}{8}$ in total head length, eighth ray $1\frac{1}{2}$; Anal **I**, 8, seventh ray $1\frac{1}{2}$; caudal $1\frac{1}{6}$, pointed ; least depth of caudal peduncle $3\frac{7}{8}$; pectoral $1\frac{1}{3}$; ventral $1\frac{1}{3}$. Brown above, under surface paler though more or less soiled ; back and sides mottled and marbled with dusky. Iris slate. Spinous dorsal gray, clouded with dusky, leaving some small white spots and rather large conspicuous black blotch on penultimate membrane medially. Soft dorsal gray with dusky reticulations. Caudal pale above lower portions gray with rather broad blackish transverse bars. Anal blackish, with scattered small spot basally. Pectoral with scattered dusky and blackish dots. Ventral neutral dusky terminally, outer borders pale or gray.

One 93 mm.

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES

BEING

NATURAL HISTORY NOTES

BY

COL. A. E. WARD

PART VII

(*Continued from page 11 of Vol. XXXI*)

Family—*Hyænidæ*

Genus—HYÆNA

This group is in India represented by

The Striped Hyæna—*Hyæna striata*

Vernacular names.—'*Lakha-bagh*, or *bagha Lakra*'—and most commonly '*Chirak* and *Jhirak*'.

Colour.—Darkish grey, sometimes of a brownish hue, traversed with tawny stripes, these are often of a blackish-brown colour, and are on the body and limbs.

Dimensions.—Head and body about 3½ feet, tail with hair under 1½ feet. Skull of a large male 8″ basal length, zygomatic measurements 6·1″. Weight 63 lbs. This specimen was shot near the Jumna bridge at Kalsi in the Western Dun.

It is not often that a hyæna can be weighed as the carcase is left as a rule when shot.

Distribution.—Very rare in Kashmir but has been found on the Murree road and in Hammel. It is fairly common in some of the hill districts with which we are concerned, and practically throughout India.

Habits.—It is not uncommon to turn hyænas out of short grass whilst beating with elephants in the Terai; on more than one occasion I have shot hyænas within a few feet of the elephant's trunk, killing dead with a charge of large shot. A big hyæna was very troublesome in a cattle-breeding farm. I camped in the farm and spent two days looking for the animal and eventually got close to it. It was eating the body of a calf within a few yards of the sheds, and to my intense surprise I killed it dead with a charge of No. 5.

Whilst staying with a regiment in a Musketry Camp in the hills, there was a good deal of trouble with the very disagreeable cries of hyænas at night. We used to turn out with guns, but although we saw the animals we were unable to shoot owing to the tents being so close together. They occupied any small and convenient patch of ground nearby inspite of the fact that in camp were several dogs which the men used to loose after barking deer or jackals.

We were sitting in the mess tent after our meal, when we heard the men urging on their dogs. The sides of the tents were up and we were just turning out to see what was afoot, when a hyæna rushed under the table and bolted out at the other side! Beyond a chair being broken no harm was done. The hyæna ran down a ravine followed by the dogs, but apparently they did not care to face it.

Dogs, unless very wary, are apt to be greatly mutilated by hyænas; with their powerful jaws they can crush the leg of any dog.

Hyænas can be ridden down on a fast pony which is handy at turning.

The fossils in the Siwalik Hills and elsewhere in the vicinity point to there having been other species of the Hyænidæ in India, and it is believed that *H. crœata* was amongst these. Besides these above, fossils have been found in Madras. In certain parts of the submontane districts, a class of hyænas exists which are small, and are far less striped than those of the lower Punjab hills—these are only a local variety of *striata*, the only species now found in India.

ORDER—*CYNOIDEA.*

Family—*Canidæ*: Dogs, Wolves, Jackals, Foxes.

The differences in the footprint of a dog and a cat consist in the two central toe pads in the former being in advance of the side pads, making the footprint longer, and in the presence always of blunt nail prints, owing to the claws being non-retractile. The dentition consists amongst other teeth of four upper and lower premolars respectively whilst the cat has three premolars in the upper jaw and two in the lower jaw.

The genera are known as *Canis*, *Cyon* and *Vulpes.*

Canis includes the wolves, *Cyon* the wild dogs, *Vulpes* the foxes.

The Wolf—*Canis lupus*

Vernacular names.—*Ratnakin* in Kashmir—*Chanku* in Tibetan—*Baglura* in many jungles, where this name is given to both the Panther and Wolf.

Colour.—Wolf skins are not as variable in colouration as is generally supposed to be the case. Nearly all Tibetan wolves are grey or greyish-white with slaty under fur; some show a brownish tinge mixed with white hairs. The tail is tipped with black. A few wolves are black due to melanism. Brownish-black wolves of the colour sometimes shown by a wild cat as far as I know are rarely seen.

I have seen a black and a grey wolf with the same mother. Doubtless as was the case with the wolves which have been brought home to England, black cubs have been born from a black parent.

Alsatian hounds have been bred with wolves; the cubs are apt to fight amongst themselves, but are quite tame and affectionate to their owners. These cross-bred hounds are often difficult to rear, they are great feeders, and are very delicate during the first year of their lives in India.

Distribution.—The species *C. laniger* is from Tibet and Ladak; the pelts sold in Srinagar are those of this class.

Habits.—Wolves are by no means nocturnal although they rest during the heat of the day. I have seen a she-wolf stand for hours in the scorching sun of Ladak, with her cubs secreted in the hills behind her, she was doing sentry-go between her offspring and the intruders.

Wolves carry portions of their prey to their caves; I doubt the wolf being much of a carrion feeder for the simple reason that they hunt in small packs and eat all the flesh of the animals they have killed, and leave the bones to be picked by carrion-eating birds. I cannot say much regarding the habits of *Canis lupus*; they are rarely seen except when travelling.

Dimensions of a very large Tibetan wolf: Head and Body 3′ 10″, height 2′ 5″, weight 60 lbs. Blanford gives a large skull as 8·7″, basal length and 5·5″ in zygomatic breadth. I tried in vain to shoot wolves in the hills between the Saseer Pass and the Shyok but could never get near them. Three wolves stood on a bare hill and watched; directly I moved they were off and when I followed them over a low hill, they watched me from the slopes of the main hill, and as soon as I showed myself, although I was lying prone on the ground, they galloped away. This occurred on the southern slopes of the Karakoram where probably the wolves had rarely seen a man.

The Indian Wolf.—*Canis pallipes*

Vernacular names—*Bheriya*, *Bagyar* and *Landga.*

Probably the best known name is *Bheriya* whilst *Langda* is the name in Gondwana.

Colour.—Grey with a very decided brownish hue; dark on the back —much browner than is *C. lupus.*

Dimensions.—Much smaller than *C. lupus* rarely exceeding 3 feet apud Blanford skull has 6·85″ basal length, and 4·4″ broad—weight from 40 to 45 lbs.

Distribution.—The plains of India, not ascending high into the Himalayas; at one time common in Abbottabad and Hazara, rare in the Punjab ranges, very rare in the Vale of Kashmir.

Habits.—Gregarious to a limited extent, possibly they would be more so, were they not continually being hunted down. Government is always on the watch to destroy wolves as they are very destructive and kill horses, cattle, sheep, goats or any live domestic animals they come across. Antelopes are systematically hunted by three or more wolves working in unison, whilst wolves which take to killing women and children are much to be dreaded.

The largest wolves I have seen dwelt in the open ground in front of the old Fort at Fatehgarh.

The Jackal.—*Canis aureus*

In vernacular—*Gidar*, *Shial* are probably the commonest names —*Shal* in Kashmir—*Hokol* in Gondwana—*Ihigal* according to

Blanford in Persia but this name is often used by Mahomedans. There are many names besides these. In parts of the C.P. '*Chota-Bagh*' is often the name.

Near Rewah territory I was taken on an elephant for miles, in order to shoot a *Chota-Bagh*, which I naturally thought was a young tiger or a leopard. On arriving at a small village I knew that I had been sold; I was taken to a thorn bush and there was the 'Jack'. This was in May! However the information was correct; the headman said the *Bagh* eat their 'murghis'. I could not help laughing, much to the disgust of the mahout.

Colour.—Pale rufuous—sometimes reddish. Albinos are very rare. Blanford mentions 'coal black'—often brown hairs on the back tipped with black.

Dimensions.—Jackals are often very large in Kashmir, where they are very destructive to sheep.

Head and body of a large jackal 31″—weight up to 25 lbs. a fine female weighed 19 lbs.—a male weighed 22 lbs.—both were killed in the winter.

Distribution.—Throughout India, ascending the hills to about 5,000′ or more. A few days ago jackals were calling at 7,500′ and I have known them to ascend to much higher elevations.

Jackals eat certain fruits notably *Zizyphus* (ber) also Indian corn. The vernacular name *Phial* is usually applied to the Jackal when frightened. The name *Phiaow* is also used, it is a mistake to think that these terms only apply to a 'Jack' which is frightened by a tiger or leopard as they will *Phiaow* even when pigs or bears or wild dogs are on the move.

Genus—*Cyon*

The Indian Wild Dog—*Cyon dukhunensis*

The only Vernacular names I know are *Ram-Hun* (Kashmiri) and *Jungli Kutta—Ban Kutta—Bhansa*. *Bhansa* in the Eastern Himalayas.

Colour.—Red. I cannot call to mind ever seeing rufuous grey or light brownish-grey (Blanford), but I have seen brownish-red wild dogs; there are sometimes dark tips to the hairs on the back. Lighter red below. The pups are sooty brown.

Dimensions.—Head and body 38″, tail with hair 14″—weight 28 lbs.—heaviest known weight 32 lbs.

The habitat extends throughout India in forest land, ranging high up in the Himalayas. In parts of the upper Indus Valley it is fairly common, but is gradually being reduced in numbers. The wild dog is very rare in the Vale of Kashmir, I have not seen one for many years past, nor have I seen the skins in the shops except one or two from Baltistan.

Habits.—Gregarious and predatory, living on any animal killed. They hunt in packs and take Sambhar, Nilgai and all sorts of deer, while cattle, sheep, goats and ponies fall, easy victims to their rapacity. Even leopards are persecuted by wild dogs and compelled to take to trees for safety. They are often heard whilst hunting at night and over and over again have I listened to them whilst lying awake in the jungles.

That wild dogs call when hunting is true as I have watched them at a few yards whilst doing so. When running by scent they only whimper, but when the prey is in sight and at hand, they often break into an undescribable howl.

Cyon dukhunensis breed in colonies in burrows in soft ground, also in caves or holes amongst rocks, hunting the surrounding jungles. Having once found a colony, it is as well to set to work deliberately and smoke them all out. The young are probably smothered ; those able to run about get into the surrounding grass and can be beaten out by a line of elephants. They are hard to hit with a bullet whilst dodging through the grass, and unless close, are still more difficult to kill with shot.

A colony was breeding within about a mile of a jungle where there were tigers. Strangely enough no foot prints of the dogs were to be seen in the vicinity and it was evident that they gave the big cats a wide berth and both refrained from interfering with each other.

The breeding season is in the winter months as a rule, but I have seen quite small pups in May.

The period of gestation is probably nine weeks.

The Indian Fox—*Vulpes bengalensis*

Vernacular names : *Lomri—Lom* in Hindustani, *Lomri* and sometimes *Lhal* in Jammu, *Kokri* and *Khakri* are names which are sometimes heard in Northern India ; I have heard the name *Kokri* in the Punjab.

Colour.—From light to reddish-grey. Jerdon remarks, ' The fur just after it has assumed its winter coat is very beautiful, a pure grey in the body contrasting with the rufous limbs.'

I have often watched various foxes during the morning and evening hours and invariably remarked that early in the morning *Vulpes bengalensis* does not seem to be in the least hurry when moving off to the burrows. It is seldom that it is to be seen carrying food, homewards, but when so doing it proceeds very warily.

Dimensions.—Vary a good deal. Length, head and body 19 to 22″ generally about 22″ ; tail 12″ weight of a full-grown specimen 6 to 7 lbs.

Distribution.—According to Jerdon ' found throughout India ' rare in forest countries. Blanford and others put the limit at ' not recorded west of Sind and the Punjab.' Personally the extreme west I have seen it is in the Jammu Province, Sialkote and adjacent localities.

The Common Fox—*Vulpes alopex*

Vernacular names : *Lomri. Laash* is not the Kashmiri name for the common fox, it is the name usually for any kind of cat. It is quite impossible to give any standard of *colour* to the Himalayan variety ; go to any furriers shop and you will find pelts of almost any colouring. On the other hand *V. flavescens* is a superb fox of almost a universal yellow, often with a tinge of golden-rufous. The weight given by Jerdon as 14 lbs. is fairly correct, but 18 lbs. has been recorded. The average weight of six male foxes is 12 lbs. The price of a pelt is about Rs. 25.

Turning to the Himalayan form. The colouring on the back varies from red and yellow, to dark grey and very rarely to black. The sides are pale. Ears are jet black outside. This portion of the skin is stitched together and made into collarets, fetching of course very high prices. The ears inside are generally buff. ' The face is rufuous, there is a large black spot in front of the eye and the cheeks are white ' (Blanford). Tail nearly always grey ; the tip of the tail is white.

Habits.—These foxes dwell in burrows or amongst rocks at an elevation of 5,000′ to about 8,000′. In the summer the cubs come out in the afternoon and play about on the swards of green turf ; the vixen generally rests half hidden by some bushes and at the slightest sign of danger she utters a shrill bark repeating it at short intervals, finally if any of the cubs are too keen at their play, the mother races across the grass, the whole family following and they are soon lost to view. Probably none of them will be seen for some days. I have never seen the mother and cubs dart into their homes when frightened. Cubs will often play at the entrance of a cleft in rocks whilst the mother lies secreted under cover. Seldom more than five are produced at a birth and by August they are sufficiently well grown to be able to escape from most terriers.

The Small Tibetan Fox—*Vulpes ferrilatus*

Vernacular Names : *Igar* (Tibetan) according to Blanford. I have heard that name in Little Tibet. *Lokri* is the common name.

Dimensions : Head and body 19″ to 20″ ; tail with hair 12″.

Habitat.—Tibet, with a considerable distribution from the Northern Sutlej to the East.

Colour.—Reddish-yellow, tail plain grey, tip of the tail pure white, breast and stomach pure white.

The pelts of this fox are not common in the furriers shops, but from time to time a certain number can be selected which are so much of one size, and approximately of the same colour, as to justify the placing them as belonging to a race of foxes which come from the same locality. The traders who bring down skins give but little help. I think *V. ferrilatus* comes from nearer to our borders than do other varieties of *V. alopex.*

(*To be continued.*)

FORAGING TERMITES

(*EUTERMES BIFORMIS*, WASM)

BY

R. W. G. Hingston, Major, I.M.S.

(*With a plate*)

The place of investigation is Central India, the district of the Bundelkhand gneiss. Here we stand on the primitive floor of the Peninsula, those crystalline rocks on which have been deposited all the later sedimentary beds. It is a tract of undulating uplands, wide flat spaces, rocky ridges, crumbling granite hills. Vast areas of it are bare, stony and neglected ; other tracts are clothed profusely in forest or thorny scrub.

Eutermes biformis, a species of White Ant, is particularly partial to this kind of soil. In places I find it in great abundance, colonies under almost every stone. Here we have a species of peculiar interest. It raises no mounds, builds no elaborate nor conspicuous city, possesses none of that architectural capacity so commonly met with amongst the white ants. As an artificer it has not the slightest merit. Its interest lies in its absence of seclusion. The mound-building termites hide beneath the soil. When they move about they always do so beneath tunnels. Rarely, if ever, do they come into view. All their work takes place in the strictest seclusion, which makes them particularly difficult to observe. We must disturb them before seeing them at work. It is otherwise with *Eutermes biformis*. This venturesome species has open-air habits, excavating, foraging, guarding the termitarium in the full light of day. From it we will learn some facts about termites which otherwise we would never know.

As in all the species, we find workers and soldiers. The workers are pale yellow, with shining heads that show not a trace of eyes. The soldiers are of two distinct sizes, small ones that scarcely exceed one-tenth of an inch, and large ones that are almost one-fifth of an inch long. In one point they differ remarkably from the workers. Their mouth parts are very peculiar. They have no trace of jaws or any type of biting organ ; in their place is a conical pointed spear, a kind of tubular beak. Obviously their work is altogether different from that which falls to the worker class. In addition the community has its males and females, very much larger than the workers, and provided with eyes and wings.

The Nest

Nothing special marks the *Eutermes* nest, no mound, no heap, no citadel of spires. All it does is to make a superficial excavation scarcely more than a few inches in depth. It seldom goes down beyond a foot. If the insect has any preference in the matter, it likes to establish itself underneath a stone.

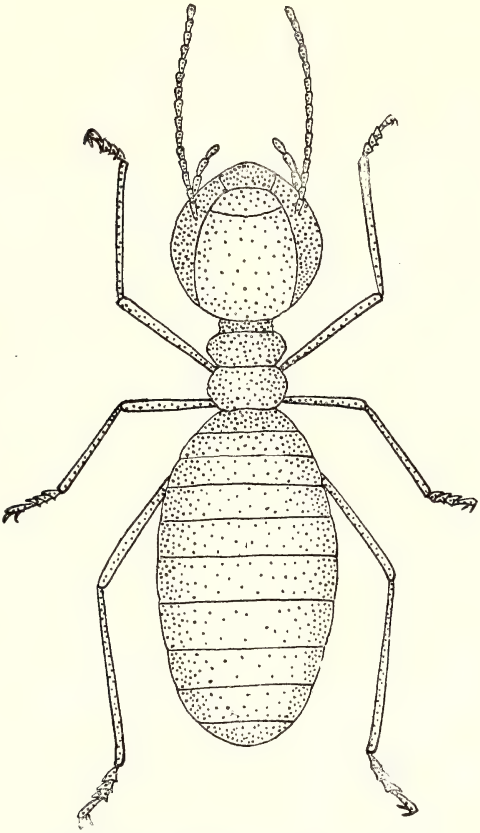
The nest consists of a ramification of passages, a reticulated system of galleries and chambers, their width being equal to about that of a lead pencil. They appear to have no particular arrangement, but just ramify and communicate in all directions. The patch of ground is literally honeycombed with the network. When exploring it we seem to be cutting into a sponge. The walls of the passages are a little roughened and usually lined with a black material. This pigment, at first sight, looks like some fungus; but more probably it is the excreta of the termites which they smear over the walls.

The galleries are always perfectly clean. What do we find in them? First of all, nurseries. Special chambers appear to be reserved for this purpose. In them we find young of all ages and sizes heaped together in a scrambling mass. Hundreds may be kept in the largest of the nurseries. Others are met with scattered through the galleries. Less often we come across sexual forms, perhaps only a few inches beneath the soil. The only other stuff I have recorded from these galleries are fragments of half-chewed grass.

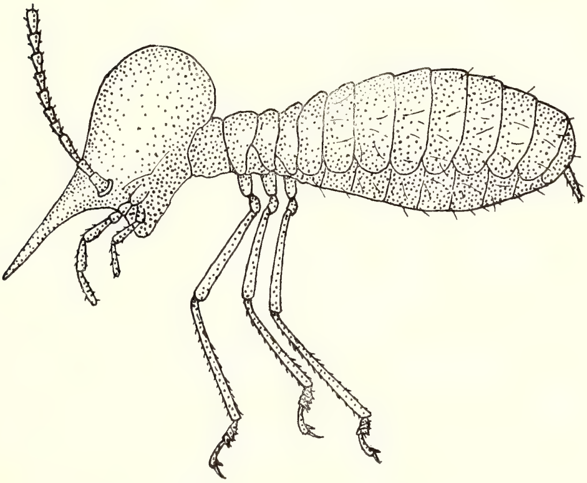
I have said that these termites emerge into the open, so let us try and catch them at nest-building work. How do they excavate their network of galleries? It is not a sight that we can see at any time. But, if fortunate, the following spectacle presents itself. A stream of termites issues from the nest. All belong to the worker class. Each carries a load of excavated material, a small damp pellet of earth, which it casts away on the rubbish heap. The stream moves slowly, carefully, methodically. Though all its members are completely blind, yet they advance with the same certainty as if they had perfect sight. It is obvious that their antennæ feel out the way. The load deposited, they return for more. In fact their manner of excavation is identical with that of the ordinary ant.

But where are the soldiers in this important business? These diggers and carriers are all workers. Not a single soldier takes part in the toil. What is their function? Have they no part in the making of the nest? They have a part, and a very remarkable one. Look along the edge of the excavated earth, the material which the workers are heaping into a mound. There the soldiers have taken their stand. They have formed a ring, a martial circle, a defensive barrier around the heap. Within the circle is the stream of workers carrying and casting down their loads. Both types of soldiers join in this rampart, the large ones are twice the size of the small ones, yet their duties appear to be the same.

Here is a social system most elaborately organized, the peaceful toilers, the martial ring, the military machinery ready for war. It is worth looking at in closer detail. The martial ring is a circle of sentinels. They are fairly evenly distributed: there may be fifty or a hundred of them: they do not run about, but stand stationary in the circle, each keeping to its allotted place. All face outward, their dagger-shaped beaks away from the nest opening, their heads a



Eutermes biformis, WASM, WORKER.



Eutermes biformis, WASM, SOLDIER.

little elevated, antennæ held erect, and trembling as though feeling for danger in the air. It may be only an insect spectacle, a vision of little and unimportant things. But little things are big things when viewed in proportion. And here we see termites with that organized machinery which brutalizes civilized life.

Clearly this is a military system. Let us watch the barbarous machinery at work. I disturb the excavators, the worthy toilers that are carrying out the earth. Instantaneously a retreat is sounded. The labourers make no attempt at resistance. In half a minute all are in the nest. Not a worker is visible; the martial element holds the field. The soldiers, to a man, remain outside. A mad excited frenzy seizes them. They rush about on the heap of debris. Eager for battle, they seek out the enemy. The martial ring disintegrates for fight.

This is the first lesson taught by *Eutermes*. How highly developed is the military machinery amongst creatures so low in the scale. It reminds us of Hymenopteron society with their labourers, their soldiers and their defensive methods. But the militarism of *Eutermes* is more impressive than that of ants. In *Eutermes* the castes, both in structure and strategy, are far more strikingly distinct. Nevertheless ants have sometimes been observed making the same kind of martial ring. But never, I feel sure, with the perfection of *Eutermes*. Moggridge saw *Atta barbara* making rings around its queens to protect them from lizards which would not pass through the ring. Miss Cheesman in the Society Islands saw something similar with *Pheidole*. She gave food to the ants. Their soldiers made a ring around it, kept back all other competitors while the smaller workers took it piecemeal away.

In the higher forms of termites the military organization is well displayed at the nuptial flight. Take *Odontotermes feæ* for example. Workers first break open the galleries. Then the winged forms squeeze their way out, hundreds emerging one after another and ascending into the air. In an hour or more the eruption ceases. Then the breaches have to be repaired. Workers come forward to seal these openings. And now for the first time soldiers appear. They do not come out completely from the galleries. Their method is to remain within the passage and from there line the breach. We see their heads protruding above the margin, clearly keeping a strict guard while the workers seal the opening with clay.

Foraging Expeditions

We leave for a moment these military adventures and turn to more productive manifestations of life. *Eutermes* despatches foraging columns, mainly for the purpose of collecting grass. The expeditions take place in the monsoon evenings, an hour or two before the sun sets. A sharp eye is needed to detect them; for the column of pale flesh-coloured workers is almost invisible against the soil. A course is made for the harvesting area, some suitable patch of grass usually about three or four feet from the nest. A pathway is formed on which the insects move. Their method is like that of harvesting ants. Those facing outward are empty-handed; those returning are laden with grass. The march is orderly. In coming and going they pass one another, and move without confusion along the path. Each individual with its leafy load reminds us of the leaf-cutting ants of America that advance beneath a Birnam wood. I have seen many thousands on these foraging expeditions; the whole nest seemed to have been abroad. On such occasions they are extremely timid. The slightest interference alarms the mass which turns about and hastens indoors. In the harvesting area we see quiet activity. Some individuals mount the blades, cut off the tips of the vegetation and allow themselves to fall with the separated ends. Others find suitable fragments on the ground, either green cuttings that have dropped from above, or pieces of dried stalks. In the business of transport they are individualistic. Each sticks to its own load. They cannot combine to shift a large mass. Here again they resemble the harvesters and certain of the insect-hunting ants.

Now for the part taken by the soldiers. It is only the workers that cut and carry grass. The soldiers are unfitted for transporting operations, even if they had the instinct to work. Their mouth-parts, as I have said, are shaped into a spear, an implement that could never grip a load. But the soldiers are not absent from these harvesting operations. As in excavating, so in foraging, the warriors have important duties to fulfil. Soldiers mix themselves in the harvesting column. It reminds one of social hymenoptera on the march. Others stand along the foraging track, others scatter around the collecting area, some ascend the blades of grass. Wherever the toilers extend their enterprise, there the soldiers also appear. Their business is to protect the foragers, in the same way as they did the excavators, though the irregular nature of the ground does not lend itself to the martial ring. Interfere with the steady stream of industry. Immediately the soldiers are up in arms ready to attack anything that comes. When alarmed, the foragers set about retirement; the stream of labourers pours back to the nest. But the soldiers remain out until all have disappeared; then the warriors themselves withdraw, forming, as it were, a rearguard to the mass.

Another small experiment shows their military instinct. I kill a worker while it is engaged in foraging. Another worker finds it, drags it towards the termitarium. Soldiers assemble, close around it; a martial ring, or is it a ring of mourners, is formed round the moving corpse. The procession advances, a funereal spectacle, the bier, the corpse, the military assemblage all go steadily into the nest.

Why does *Eutermes* require all this soldiering? What is the particular enemy they fear? I have little doubt that ants are the danger. How often have we seen the ravager, *Lobopelta*, breaking through the earthworks of a termites' nest.

So dangerous to *Eutermes* are insect-hunting ants that the species often builds covered roadways along the surface of the soil. They are nothing like the extensive ramifications of other termites, but are just low tunnels fashioned out of earth. As a rule they are short and project from the nest opening; seldom are they more than an inch or two in length. Such a scanty surface architecture does little more than guard the entrance to the termitarium. It is all that remains to the foraging species of other termites' pyramids and domes. The building of these roadways is done in daylight; in fact building and provisioning may go on simultaneously. Division of labour exists amongst termites with the same efficiency as in ordinary ants. We see some workers carrying clay from the termitarium, others moulding it to the roof of the passages, while others at the same time collect grass. The foragers keep close to the end of the tunnel, scarcely going farther than half an inch from it. They get hold of the nearest blade of grass, gnaw it off, drag it into the tube. The work is done with apparent timidity. The object of the tunnel is to permit the workers to get without exposure to the nearest patch of grass.

Duties of Soldiers

This is clearly the most interesting point. The soldiers possess two important functions, different from those of the ordinary worker. (1) The function of their antennæ. (2) The function of the pointed beak.

First let us see the function of the antennæ. I uproot a stone, one beneath which a nest is established, and, in doing so, I break through the reticulated walls. Termites burst forth, a violent eruption, which very quickly subsides. Then the work of repair begins. The soldiers seek out the broken galleries; they gather along the edge of the breaches. The ordinary workers for the moment disappear, withdrawing themselves into the labyrinth of tubes. Soon the workers reappear, bringing with them whatever fragments of material they can find, pellets of earth, nodules of grit, pieces of dry grass. A moistening with saliva makes these fragments viscid. Then they are glued into the breach. They are not merely laid in position. The workers with an oscillating movement of the head screw them forcibly into place.

Now let us watch the behaviour of the soldiers. In this work of building they clearly have duties other than those of defence. Collecting along the edge of the rupture, heads turned outward, antennæ expanded, they stand apart at fairly even distances so that the antennæ of each soldier just touches those of its companion on either side. In this we have the strategical ring. But when we watch the soldiers' antennæ we see that they do something more. We notice that they are all the time swaying and touching; they give the impression of estimating distance and in some way measuring the work. I little doubt that they are being used as calculating organs, measuring out the extent of the damage and determining the progress of repair. The soldiers in this way act as supervisors while the workers apply the bricks. The breach now rapidly contracts. Soon the antennæ of the supervising soldiers can touch from opposite sides of the rent. They now know that repair is nearing completion. Hence they withdraw into the gallery; only their heads appear in the breach. Their antennæ still project, gently swaying, and gauging how much remains to be done. Brick after brick is brought by the workers; in the end the soldiers all but disappear. Only the tips of their antennæ are visible when the last few bricks are moulded to the wall.

Here we have a clear division of labour. Measuring and calculating falls to the soldiers; labourers do the ordinary toil.

Now for the purpose of the pointed beak. Of course this is the organ of defence. While the swarm is engaged at harvesting I place an injured cricket near the nest. This to the termites is a terrible invasion. All the workers rush for the entrance. Soldiers dash in and surround the invader. Some of them shoot jets of poison from their beaks. All their military tactics are called forth. When the workers withdraw the soldiers follow them. As soon as all are safely housed the soldiers take up a position at the gate. A martial group occupies the entrance, their bodies are kept in the interior, their heads appear at the open door. In fact the gate is lined with soldiers, and bristles with antennary threads. Now comes the final act of defence. While the soldiers hold the entrance the workers build a rampart across it. Loads of earth are carried up until the door is firmly sealed. How human-like are these military tactics. First an attack, then a rearguard action, then a picket holding the last defences while a suitable rampart is thrown up. Again we see how like they are to ordinary ants. *Messor barbarus*, for example, under similar circumstances defends the open gate of its formicary by placing across it a barricade of stones.

I have said that, when attacking, they shoot out poison. This brings me to the soldier's spear. The weapon is not particularly sharp, being really a cylindrical tube intended for ejecting spray. When the soldier is annoyed it shoots out from the spear a jet of clear sticky fluid, liquid on emergence, but hardening on exposure. It oozes out like a rope of viscid treacle and then falls in glutinous coils. It has no effect on litmus. Its smell is distinct. Sometimes it comes out in a series of spurts as if driven with definite force. Thus is the spear a defensive weapon, not, however, a penetrating dagger; it is more in the nature of a poison syringe. It must be of great value against natural enemies, of which the carnivorous ants are chief. A rearguard of soldiers standing at a gateway or swarming on the breach of a broken gallery, with their poison spears all directed outward, offer an impregnable front to attack. Woe betide the enemy smeared with their discharge. Its joints, mouth-parts, legs become clogged; gravel, leaves, everything sticks to it. If it does not escape it gets glued to the ground.

SPECIAL SENSES

Touch.—The antennæ, of course, are the tactile organs. Thrust out in front, they touch every object and carefully explore the way. For the soldiers they seem to serve as measuring implements on those occasions when the passages are under repair.

Smell.—Like ants, they possess a good sense of smell. In one place the stream of foragers led over a smooth stone. I rubbed my finger a number of times across their path. This disturbed them, but only slightly. The line became broken where I had interfered. New arrivals hesitated to cross. My rubbing had done something which checked their course. Soon, however, they regained confidence. The stream continued as before. Ants, like *Messor*, would have been much more inconvenienced. Yet this incident clearly shows that *Eutermes* has some sense of smell.

When the foraging army was returning to the termitarium, I placed a nodule of camphor in their path. They were instantly aware of it, clearly disliked it. Before ever their antennæ touched it they halted and turned aside. Very soon the whole army was deflected and had to reach the nest by a circuitous route.

Around the nest entrance I made a ring of camphor. The army was abroad. News of the interference quickly reached them. Much alarmed, they called a retirement. But the camphor blocked them. They would not approach it. Though madly determined to reach the next aperture, yet they were utterly cut off. They were as isolated from the termitarium as if it were surrounded by a watery moat.

These simple experiments indicate clearly that termite activities are mainly guided by their keen sense of smell.

Hearing.—*Eutermes* has a peculiar habit which suggests an auditory sense. When alarmed, they erect themselves, shake their bodies, rapidly and forcibly oscillate their antennæ. Both soldiers and workers adopt this manœuvre. It is very evident when a nest is disturbed, or when a soldier is irritated with a straw. The act is a plan of communicating danger. When one termite erects itself, its neighbours become alarmed. Others at a distance catch the infection; if the army is abroad the news quickly spreads and in a few moments all are racing for the nest. The communication is not visual. *Eutermes* is blind. Can it have an auditory significance? Certainly it is very like that of the Red Ant. *Oecophylla* erects itself, jerks its body, hammers the surface of a leaf with its abdomen. A tapping noise is produced in this way, a trumpet that spreads alarm. The vibrations of *Eutermes* give no audible sound, at least nothing that we can hear. Perhaps it is beyond the range of human hearing. For we might anticipate auditory powers in insects deprived of sight.

The suspicion of an auditory sense is strengthened by the fact that Smeathman observed a marching Termite in Africa which emitted a distinct noise. He saw columns of workers issuing from a hole, marching under the direction of enormous soldiers which climbed up the plants and made audible signals to the marching column who responded with a hissing noise. Also Bristowe detected two kinds of noises made by a Brazilian species of termite. He refers to the soldiers of *Conitermes similis*. Some of them jerked their bodies up and down and made a tapping noise by a movement of the chin. Others by sharply crossing their mandibles produced a noise like the snapping of thin glass. More than likely *Eutermes biformis* can emit some sound inaudible to us.

Sight.—A word disposes of this faculty. Both soldiers and workers are totally blind.

Recognition of one another.—Ants, as is well known, are friendly to their comrades, but hostile to members of another community though belonging to the same species. Furthermore we have reason to believe that each ant can distinguish every other ant within the confines of its own nest. Is there anything of this kind in the termite community ?

I take a worker from one nest and transfer it to a gang of the same species employed at collecting grass. The gang refuses to accept the worker. Indeed they show it every mark of hostility. A soldier meets it. The alarm is sounded. Other soldiers arrive, shoot their poison at it, and soon have it helpless on the ground smeared in viscid juice. Thus *Eutermes* like ants shows communal independence. The members, though all in harmony with one another, are hostile to the members of other nests.

Comparison with Hymenoptera

The chief point that strikes us in this record of behaviour is the close resemblance in small details between *Eutermes* and the Hymenoptera. A termite and an ant are as different in structure as are a dragon-fly and a bee. Yet see their detailed resemblance in behaviour. I do not refer to their social organization, a resemblance that has frequently been pointed out. I am concerned only with details of behaviour as exemplified in this daylight haunting species.

Their mode of excavation is exactly like that of ants, the gang of porters carrying out the loads and pitching them down on the rubbish heap. The protective ring of stalwart soldiers calls to mind a nest of *Camponotus compressus* where idle monsters move about the rubbish heap and smaller labourers eject the earth. We have also seen that *Atta* and *Pheidole* do occasionally manufacture a ring. Disturb *Eutermes*, and the soldiers show fight ; so do the *Camponotus* monsters while the busy toilers hasten underground.[1] How very like are their foraging expeditions to the seed-collecting habits of *Messor barbarus.* We have the common path, the harvesting area, the coming and going with individual loads. Their cutting of the vegetation is like the leaf-collecting *Oecodoma* where each reaps its leafy fragment and bears it away to the nest. Their march is on the plan of the foraging Ecitons, the stream of workers, the scattered soldiers, each with its duty to perform. The building of arcades is done by *E. vastator* which spreads along the ground a covered roadway underneath which the workers advance.

Ants are renowned for their division of labour. With *Eutermes* we have excavators, builders, provisioners, each to its own task. Their rampart of defence is the plan of *Messor barbarus* which keeps out the enemy with a barricade of stones. Ants are particular in disposing of their dead. We are even given an instance of a funeral procession where a long and organized stream of workers followed the corpse to a special grave. Such a story might be thought to be purely imaginary. Yet what have we seen in *Eutermes biformis* ? ; a funeral ring encircling the corpse and retiring with it into the nest. Their sensory capacities are in many ways like those of ants. Their sense of smell seems identical with that of *Messor barbarus* which camphor distracts in exactly the same way. They communicate danger by shakings and jerkings, not at all unlike the plan that *Oecophylla* adopts. Lastly we see that recognition characteristic of ants in which the members of a community are friendly to one another but hostile to the members of other nests.

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[1] The habits of these Indian species of ants have been described in *A Naturalist in Himalaya* and *A Naturalist in Hindustan.*

I conclude with a quotation from Professor Wheeler. He is referring to termite communities far more highly organized than mine. ‘When we reflect that ants and termites have been able, through slow physiological and instinctive processes, independently to evolve such strikingly analogous peculiarities as those I have described, we can scarcely doubt that different human communities, belonging to the same species and endowed with some intelligence, may frequently have hit upon the same inventions.’

FURTHER NOTES ON BIRDS ABOUT SIMLA

BY

HUGH WHISTLER, F.L.S., F.Z.S.

In Vol. xxvi of the Journal, pages 770-775, I recorded a series of observations made about Fagoo near Simla in 1918 and followed it up in Vol. xxvii, pages 94-111, with a further series of notes made in 1919 in Simla. As it was my good fortune to be posted as Superintendent of Police, Simla, for the season of 1925 and as there is no liklihood that I shall ever visit the Simla Hills again, I take this opportunity of setting on record the more interesting of my notes made in that year. I arrived at Simla on February 6, 1925 and left it again on October 23 of the same year. Before the season started I was able to make short tours to Sabathu, Dagshai and Solon from February 27 to March 4 and to Narkunda, Koteghar and Kotekhai in the second half of March. For the rest of the time I was confined to Simla or localities within reach of a day's expedition.

Nucifraga hemispila, Vigors. The Himalayan Nutcracker.

Common from about 6,000-9,000′ in the hills behind Simla as near as Mashobra and Mahasoo but not observed in Simla itself. I found it very common and in pairs about Narkundah from March 13 to 16 and found a nest on March 16 built in the branches of a pine close to the trunk at no great height from the ground. One bird was sitting in the nest and both made a great fuss when I examined it, so I was surprised to find that it contained a single dead chick. Both sexes apparently take part in incubation.

The flight is very similar to that of a Jay—very flapping with rounded wings and the same rather hesitating manner combined with fair speed.

Stachyridopsis pyrrhops (Blyth). The Red-billed Babbler.

A few pairs were seen at Sabathu when I was there from February 23 to 27. One was seen at Kotekhai on March 20, a pair were seen at 7,000′ in the Chirot Nala, Mahasoo on June 14.

Cephalopyrus flammiceps flammiceps (Burton). The Fire Cap.

On March 21, two flocks were met with in some willows in the Giri Valley above Parala; they were singing a low twittering song rather like a feeble version of the song of the Goldfronted Serin (*Serinus pusillus*).

It was reported as first seen in Simla on March 27 and on April 1 a pair were found building near Snowdon. This nest contained four rather incubated eggs on April 21.

On May 8 I found a pair feeding well-grown young in 7,500′ on Jakko. The nest was in a hole in an Oaktree trunk about 20′ from the ground.

Horeites pallidus pallidus, Brooks. The Pale-bush Warbler.

Several were observed about Kotekhai in the Giri Valley on March 20-21 and the song was also heard there once.

This species breeds in fair numbers about 8,000′ at Mahasoo and Kufri and from May to August the characteristic song may be freely heard in the thick undergrowth that clothes the hillsides wherever the larger forest trees have been cut. It is probably double brooded as on August 9 I found a brood of newly fledged young clicking and skulking in a rough patch of cover in the cultivation above the Kufri bazaar.

Sturnus vulgaris poltaratzskyi. Finsch. Finsch's Starling.

A solitary female of this species was found about three miles below Kotekhai in the Giri Valley on March 19. It was in poor plumage and was consorting with Common Mynahs.

Acridotheres tristis (L.). The Mynah.

Common at Dagshai 5,000′ and Sabathu in February, at 7,200′ at Koteghar in March and at Kotekhai in March.

Tarsiger chrysæus whistleri, Ticehurst. The Golden Bush-Robin.

A female was found at about 6,500′ in the Chirot Nala on March 29.

Oreocincla mollissima simlaiensis, S-B. The Plain-backed Mountain-Thrush.

I shot a male on Jakko at 8,000′ on February 14 ; another Mountain-Thrush seen the same day and on February 11 also on Jakko was probably of the same species.

Carpodacus thurus blythi (Biddulph). The White-browed Rose-Finch.

I shot an immature male (in the plumage resembling that of the female) at 8,000′ Kufri on February 22, 1925. It was a solitary bird and was feeding on the ground in a light sallow thicket on the top of the Kufri ridge. This appears to be the first record of this species in the Punjab Province.

Callacanthis burtoni (Gould). The Red-browed Finch.

I saw a male on February 17 and two females on February 18, in both cases feeding on the bank above the mall close to Gorton Castle. A flock of about thirty were seen by a friend on March 1, feeding by the side of the cartroad below the Cecil Hotel. These birds are very tame and have the movements on the ground of a heavy sparrow.

Serinus pusillus (Pallas). The Gold-fronted Serin.

On February 27, I found a flock on the cartroad about a mile from Sabathu. From March 19 to 21, I met with some parties in the Giri Valley between Parala and Kotkhai. A single bird was heard at 6,000′ on the southern face of Tara Devi by the cartroad on April 10.

Fringilla montifringilla, L. The Brambling.

I have now to recant the former opinion expressed by me in the Journal (Vol. xxx, p. 410) that there must be some mistake about Jerdon's record that the Brambling occurred at Simla.

On December 13, 1924, Mr. A. E. Jones obtained a female in his garden at Marston Grange (7,000′).

Then on February 15 and 22, I met personally with several in the cultivation at 8,000′ above Kufri bazaar. They were in company with the flocks of Stoliczka's Mountain-Finch that were common on the hillside amongst the snow and owing to the restless behaviour of the latter species were hard to obtain when with them. However, the Bramblings at times liked to rest quietly in the leafy boughs of the Mountain Oaks and were then easy to approach.

When I visited the same place on March 10, I could only find a single female in a huge flock of the Mountain Finches.

In all I obtained five specimens.

Æthopyga gouldiæ (Vigors). Mrs. Gould's Sunbird.

On April 5, I saw a brilliant adult male in the Chirot Nala at about 6,500′ ; it was hovering in the undergrowth apparently collecting spiders threads for its nest and then dashed away into the forest out of sight. The call is a note like the rapid opening and closing of a pair of scissors as in the case of *Æ. siparaja.* Near the same spot on July 12, I shot two young males. They were moving about some parasitic plants at the top of a lofty oak tree, turning incessantly from side to side and uttering the same scissor's note.

Dicæum ignipectum (Hodgson). The Fire-breasted Flowerpecker.

On February 24–25, I found several of these little birds about Sabathu Cantonment.

Dryobates hyperythrus (Vigors). The Rufous-bellied Pied Woodpecker.

A male was seen in the pine woods of Narkundah at 9,000′ on March 16.

Apus melba (L). The Alpine Swift.

A few Alpine Swifts were noted in the vicinity of Simla on various dates from April 11 to May 17.

On the autumn migration however they were observed in much larger numbers than is usual about Simla, and for a longer period ; the first birds were seen on August 21 and the last on September 24 ; between those two dates I have records of flocks seen on sixteen different days, on some days in very large numbers.

Cacomantis merulinus passerinus (Vahl.) The Indian Plaintive Cuckoo.

I heard this little Cuckoo on July 15 calling in a valley about 5,500′, below Kasumpti.

Strix aluco nivicola (Blyth). The Himalayan Wood-Owl.

On April 4 I found one of these delightful birds sitting in a holly oak bush near the ground and it allowed me to look at it from a distance of about 4 feet. It then flew off and settled near the ground in another tree. This was at 7,800′ on Jakko where the species may be heard calling at nights.

On July 12 I found two adults sitting in the undergrowth of wattle bushes at 7,300′ by the private road in the Chirot Nullah.

Strix indranee indranee (Sykes). The Brown Wood-Owl.

Only observed on one occasion (April 16) in a nullah just above Annandale in the late afternoon.

Otus spilocephalus (Blyth). The Spotted Himalayan Scops-Owl.

The characteristic call of this little owl was heard in the grounds of Viceregal Lodge on October 21.

Glaucidium brodiei (Burton). The Collared Pigmy Owlet.

This Pigmy Owlet must be quite common in and about Simla and the neighbouring hills as I heard it calling on various dates from February 20 to May 17 after which the call was not heard. A female was shot at Dagshai 5,700′ on March 2 and I observed it up to 9,000′ at Narkunda. It calls both by day and night, and is active by daylight.

Torgos calvus (Scop). The King-Vulture.

Observed as follows :—February 27 Dharmpore, March 2 Dagshai, March 3 Solon, March 8 over Tara Devi and Simla W., March 10 beyond Sanjouli, March 18, Theog, April 5 by the Tollbar. After that it was not seen.

Pseudogyps bengalensis (Gm.) The White-backed Vulture.

Observed as follows :—March 2 Dagshai, March 8 two or three on Tara Devi, May 10 about Naldera.

Gypaëtus barbatus hemachalanus, Hutton. The Lämmergayer.

On September 24 an adult Lämmergayer was brought in to Mr. A. E. Jones by some hill men, who declared that they had caught it in some telegraph wires. Although we could detect no sign of injury it was very quiet in demeanour sitting passively on the floor, a little inclined to bite if molested but otherwise still and silent ; it kept the head rather lowered and the mouth a little open. If uninjured it may have felt conscious of the hopelessness of opening its huge wings for flight in the restricted area of the room. Mr. Jones kindly allowed me to present this bird to the Society and its portrait appears in our Journal (Vol. xxxi, 198).

Hieraëtus fasciatus (Vieill). Bonelli's Eagle.

Bonelli's Eagle was seen from the railway between Solon and Tara Devi on March 2. Single birds, apparently of this species, were seen soaring over the Hotel Cecil on March 9 and by Parala in the Giri Valley on March 21.

Spilornis cheela (Latham). The Crested Serpent Eagle.

Occasionally observed about the catchment area from April to July.

Ictinaëtus malayensis perniger (Hodgson). The Black Eagle.

As there is little on record regarding this fine Eagle in the Western Himalayas it seems worth while recording my experience of it in detail.

On March 14 and 16 I saw an Eagle, which was almost certainly of this species, soaring about Sidhpur 8,500′-9,000′ between Koteghar and Narkunda, and on the latter date it also flew over Narkunda.

What was perhaps another was seen on May 10 near the Retreat, Mashobra.

On June 28 I had a splendid view of one hunting in the bottom of the Chirot Nala (catchment area) at about 7,000′. It was very dark in appearance, save for a light area in the primaries and the marked bars on the tail. The yellow at the base of the beak was very noticeable. It was a wonderful flier covering the sides of the nullah in circular beats, practically without flapping the wings. The wings and tail looked very broad and rounded, the primaries spreading out like the fingers of a hand.

On August 16 I secured a fine male at Kufri 8,000′. This was in complete moult with the organs very indistinct. In the crop was a naked nestling of some passerine bird, apparently *Trochalopteron lineatum* and in the stomach incubated eggs of a Laughing Thrush either *T. variegatum* or *T. erythrocephalum.* It seems fair therefore to assume that the marvellous powers of flight are devoted in the summer months chiefly to bird nesting and that as the Eagle quarters the hillsides it is scanning the bushes for nests. This is the only specimen of the Black Eagle I have ever secured personally and the thrill that the incident afforded will perhaps excuse the inclusion of the following extract from my diary :—

" We emerged out of the forest on to a bare spur and looked down into the head of the nullah which lay below us a thousand feet, breaking up into numerous side ravines, partly clothed in forest, and partly bare or clothed with undergrowth, in places almost precipitous. There, far below us was a Black Eagle which was hunting over the trees and undergrowth in regular beats, backwards and forwards, sailing in and out of the nullahs and contours with the utmost ease and grace. This he was doing in the head of the main nullah, and then he started to beat up the side towards where we were resting, after one false alarm in which he started towards our side and then returned to the main nullah. I told my companions to remain absolutely still without moving hand or foot as we were out in the open as the Eagle worked along the sides of the nullah, quartering the ground backwards and forwards but all the while gradually advancing in our direction, I saw that his course was steadily ascending and would probably bring him into the gap between some trees on my left. For a moment he went out of sight in a nullah so I hastily shifted a yard or two to cover that gap and waited with my 410 collecting gun (No. 8 shot) ready and cocked. In my new position I could no longer see the hillside and watch the progress of the bird but a minute or two later it suddenly sailed into the gap in front of me, and seeing me steered off to drift down hill. I fired and hit the bird which staggered and again recovered, and turning made off in the direction in which it had come ; but it was obvious that it had been hard hit. We watched it keenly as it went, and it disappeared into the deodars that clothed a side nullah ; however it did not reappear on the far side of the nullah, nor could we see it elsewhere. Obviously it had stopped in the nullah, so leaving Major C. to watch from our spur I made off down the hillside with my orderly Tulsi Ram as fast as might be consistent with caution.

I entered the deodars very quietly with gun ready loaded and every nerve on the *qui vive* to detect the wounded Eagle resting in a tree, or to hear the sound of small birds mobbing it. The sunlight and the shadow were very peaceful and quiet, and the only calls came from a large party of Grosbeaks in the trees and some Variegated Laughing Thrushes—but these all were obviously concerned only with their own affairs. There was no sign of my quarry. I passed through the nullah and emerged on to the ridge beyond and then signalled and shouted to Major C. perched on the spur above, with his handkerchief fluttering in the breeze to show his position. He replied that there was still no sign of the bird. Tulsi Ram and I then worked back into the nullah, taking different lines, and a welcome shout soon announced that Tulsi Ram had found the Eagle lying dead in a tree."

Accipiter virgatus affinis, J. E. Gray. The Besra Sparrow-Hawk.

The late Mr. Basil-Edwards kindly allowed me to examine a beautiful adult male Besra that he shot at Simla 6,000′, on June 28, 1925.

On June 18 I found a nest of the Chestnut-bellied Rock-Thrush at 8,000′ on a pineclad slope of the Chirot Nala. It contained two well-feathered chicks which as I looked at them dashed out of the nest and down the hillside. At once there was an agitated skirmish which resolved itself into the parent Rock-Thrushes trying to save the chicks from a tiny hawk, which dashed at them in a most determined manner regardless of my presence and successfully carried one of them off. This Hawk could only have been the adult male of this species, and I saw what was probably the same bird at the bottom of the nullah on July 12.

Falco peregrinator, Sund. The Shahin Falcon.

In March I found a pair of Shahins frequenting the face of a mountain close to Simla and on April 10 I discovered what was evidently the site of their eyrie in a precipice ; it was however quite inaccessible. The same birds or others were seen over Simla occasionally in June and July.

Falco subbuteo, L. The Hobby.

During the summer months the Hobby is distincly scarce in the neighbourhood of Simla and I did not hear of it until May 7, when one was reported as seen flying over the Ridge. It does however breed in the vicinity, as will be seen from the following account taken from my diary :—

"On the evening of June 17, 1925, I went out to examine a certain ridge near Simla, on which the Hobby Falcon has been known to breed for at least 10 or 12 years. The upper slopes of this ridge, looking towards the S. W. are broken by small nullahs, and covered with a fairly thick growth of Deodar forest, of no great age.

I started towards the top of the hill and commenced to work downwards in hopes of finding the whereabouts of the Hobbies. I had not gone far before I heard the screaming of a Falcon below me and was able to track it into a small nullah filled with Deodars. I accordingly took up a position on the ridge at one side of the nullah and settled to watch. It was not long before I made out a Hobby sitting in a Deodar tree where it was calling and after a short time the other bird also appeared. Both Hobbies were very noisy screaming at intervals the plaintive rising *tee—tee—tee—tee* which is common to most of the Falcons, and varying it occasionally with a harsh single note *pit pit* or *chip chip chip* uttered two or three times in succession. They kept on flying about in circles, sometimes over the trees, sometimes amongst them and often low over the ground, settling here and there on different trees.

One of the Hobbies was carrying something in its talons—apparently a small bird—which it eventually ate on a Deodar.

This behaviour went on for sometime and I then left the place without disturbing the birds.

There was no doubt from their excitement that they were preparing to breed, and I noticed a crow's nest in very good condition which seemed a likely nest for them to use, though they did not directly approach it while I was there. It was about 40′ from the ground against the trunk of one of the Deodars overhanging a mule road that wound through the nullah. This spot is at an elevation of about 6,500′.

On June 24, 1925, I returned to the spot about 5 p.m. walking along the mule road and as I approached the site of the Crow's nest the little male Hobby was visible sitting on the topmost shoot of a tall Deodar about 20 yards away. He paid no attention to me and the female was not visible anywhere so I climbed up on to the ridge, where I had sat before, and made myself comfortable to watch.

The little Falcon was sitting there on his lofty perch in complete ease, looking over the wide valley that stretched before him with portions of Simla visible on the ridges across the other side. It was cool and pleasant with a bright sun and though he was sitting quite very much at his ease he was all the time on the alert, his head turning from side to side incessantly. After a time he started to stretch himself and show systems of preparing to move, then he flew off circled once in the air and disappeared over the ridge for his evening's hunting and I did not see him again.

I waited there for sometime longer but the female did not appear and nothing happened. Then I climbed along the hillside to a spot whence I could see onto the top of the crow's nest noted at my previous visit, and there was the female sitting in the nest, where she had obviously been all the time. So without disturbing her I went away determined to allow ample time for the eggs to be laid.

On June 27 I returned to take the eggs. As we arrived at the spot there was complete silence and the male could not be seen on any of the trees, nor from below could we distinguish any bird in the nest. I had a sinking feeling that something was wrong and that the prize was not to be mine : however I told Tulsi Ram, my orderly, to go up the tree and he divested himself of his haversack and coat and started : he was not more than a quarter of the way upto the nest when the female Hobby flew out of the nest screaming once or twice and settled on a bough of a Deodar some 30 yards away. There she sat more or less unconcerned and took but little notice of the climber.

He reached the nest and reported three eggs and said that the nest was quite small and that there was no food lying about it. I told him to take the eggs and substitute for them a couple of hen's eggs, slightly smeared with mud to darken them, which we had brought for the purpose. This he did and descended again. We then stayed on the road below the nest examining and packing the eggs but almost as soon as the climber was down the Hobby took to wing and flying in a circle round the nest tree settled in a neighbouring Deodar. This she repeated again, flying close to the hillside, and after one or two more short flights she returned to the nest and settled herself down in it on the hen's eggs.

We then climbed up to the usual knoll and settled there to watch ; the female Hobby was visible through the glasses sitting very deep in the nest cavity, her back below the line of the sides of the nest ; her head was a little higher but hardly able to see over the side, her tail projecting rather upwards over one side.

For a time nothing happened : then in the distance I heard the screaming call and the male Hobby appeared from out over the valley flying rapidly towards the site of the nest : as he approached it was evident that there was food in his talons and he circled once past the nest calling, while the female answered, and after that he settled on a neighbouring Deodar. Here he sat on a horizontal bough and I could see he was carrying the partially plumed body of a small bird. The female slipped off the nest and settled in another neighbouring Deodar. The male kept on calling sometimes a sharp *pit pit pit*, sometimes the familiar screaming call, while the female answered in the same way and flew from perch to perch. Then the male took the bird in his beak and the female flew on to the bough beside him, took it in her beak, transferred it to her claws and flew away and settled in the Deodars further up the nullah where we could not see her. The male relieved of his burden cleaned his beak against the bough, preened his feathers, and then settled himself to sit patiently on the bough.

In a comparatively short space of time the female re-appeared having eaten the bird ; she then took some exercise circling in the air and settling in the various trees, calling a good deal in the process while the male sat quietly in his place ; finally she flew down to the nest and settled on the edge of it where she stood looking about her ; then she stepped down into the egg cavity and stood there, and gradually settled down sometimes putting her head down to look at or move the eggs ; and before she finally was satisfied she changed her position in the nest by a half circle.

When she was definitely settled on the eggs, I went down and had the male flushed and shot him, as the specimen was required. His crop was empty but there were a few fragments of flesh and feather in the stomach probably eaten while pluming the bird he had brought for the female. The report of the gun brought the female off the nest calling but she settled at once in a neighbouring tree and ultimately returned to the nest in which we left her sitting. Two days later I sent the orderly to remove the hen's eggs and he reported that the female Hobby was not at the nest, so she probably had deserted it on finding that the male had vanished.

In October there was a most marked migration of Hobbies in the Simla Hills. On October 3 three were visible high over the Ridge at dusk. On October 9 one was reported to me and I saw a second bird that had been shot.

On October 11 Hobbies were visible in the Chirot Nullah all day on the wing most of the time. There were at least 5 and probably more. I noticed that while the bird was soaring the primaries slanted slightly downwards, almost below the level of the back, while the bird moved in curves and circles climbing and sinking at will in the air with scarcely an effort—an occasionally shifting of the angles of the wings and two or three rapid strokes of the wings now and again being all the effort involved. Thus the Hobby soared for a space, then there would be a burst of activity and the bird flew straight with regular rapid wing beats ; next followed a swift downward stoop of a hundred feet, and again the bird was rising swiftly without effort. Thus were the Hobbies feeding or playing all day long, backwards and forwards, up and down, over the steep bare hillsides and the deep cut ravines. I shot an adult and an immature bird ; both were exceedingly fat and the former had its crop stuffed with remains of insects, apparently cicadas.

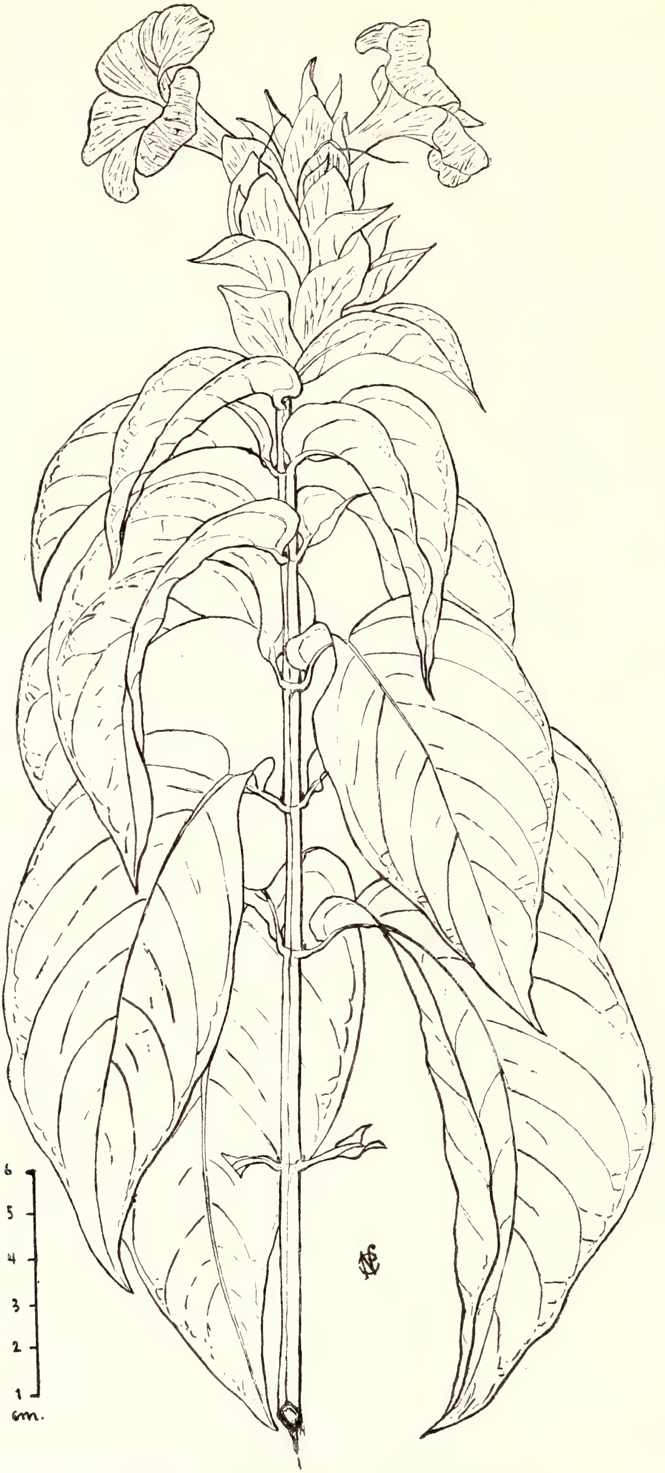
After returning to Simla I saw two more Hobbies by the Grand Hotel in the evening.

On October 13 I saw one—or perhaps more—at dusk soaring high over Gorton Castle. On October 15 I saw two at dusk high over Snowdon. The same evening there were said to be about a dozen over Mashobra and one was shot and sent to me to substantiate the record.

These birds must have moved on immediately as on October 18 I saw none in the course of a long day over towards Kufri, though the next evening at dusk saw a single bird over the Ridge.

Arboricola torqueola millardi, Stuart Baker. The Hill-Partridge.

I attribute to this species a characteristic call of the Simla hills, a very gentle melancholy *poor* or *pheaw*, which at closer quarters sounds more like *quaaw* ; it is uttered singly at short intervals and the sound carries for a long distance, being audible throughout a whole nullah. This call may be heard from 6,000 to 8,000' in the Simla hills throughout May and June and the first half of July and occasionally at other times. If my attribution is correct the Hill-Partridge must be fairly common, though I only occasionally flushed a pair on forest-clad hillsides.


6
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cm.
NC

Barleria Gibsonioides, BLATTER, SP. NOV.

Del. Norah Coady.

SOME NEW SPECIES OF PLANTS FROM THE WESTERN GHATS

BY

E. BLATTER AND C. McCANN

(*With a Plate*)

Barleria Gibsonioides, Blatter, *sp. nov.* [Acanthacea sectionis Eubarleriæ, similis Barleriæ Gibsoni, Dalz. a qua tamen recedit bracteis basi semper late rotundis, sepalis interioribus glabris exceptis marginibus ciliolatis, corolla minime glabra, seminibus discoideis, colore corollae].

A tufted undershrub, up to 1 m. high, very leafy. Stems quadrangular, very obscurely winged, stiff, erect, light green ; internodes thickened above the leaves. Leaves glabrous, except the margin which is finely spinous-hairy, leathery or papery, somewhat rigid, lowest broadly ovate or almost rounded, obtuse at the tip, lamina up to 14 cm. by up to 10 cm., the rest ovate-oblong or oblong, acuminate, up to 20 cm. by 8 cm., very variable in size and shape, shining-green above, glaucous beneath, base rounded or tapering, main nerves up to 7 pairs, depressed and whitish above, prominent beneath ; stalks of lowest leaves up to 4 cm. long, getting shorter upwards. Flowers in dense, imbricate, terminal spikes, rarely solitary, axillary ; spikes more or less 10 cm. long in flower. Bracts foliaceous, the lowest 1 or 2 pairs resembling the leaves and up to 10 cm. long, the rest getting rapidly shorter upwards and shorter than the calyx, broadly elliptic-lanceolate, acute, broadly rotund at the base, pale-green. Bracteoles at base of stalkless flower, linear, boat-shaped, subacute, glabrous on both surfaces, margin ciliolate, up to 2 cm. by 2 mm. Outer sepals 2, ellipsoid, rounded at base, up to 5 cm. long and 2–2½ cm. broad, often exactly alike as to size and shape, but one generally slightly shorter and subacute at the apex, the other acute, both distinctly nerved, quite glabrous, glaucous on the lower surface, pale green and shining on the upper ; inner sepals 2, narrowly linear-lanceolate, acuminate, boat-shaped, up to 15 mm. long, 2–3 mm. broad, glabrous, with ciliolate margin. Corolla 6–10 cm. long, minutely glandular-hairy on the margin and tube, sparingly so on the surface of the lobes ; tube 4–5 cm. long, enlarged upwards, dark purple inside and outside, lobes obovate or ellipsoid, rounded at the apex, delicately veined, mauve (light and dark), the 2 upper lobes each with a large elongated dark purple blotch beginning at base of lobe and extending 15–20 mm., blotches sometimes faint or absent. Stamens 2 ; filaments white in the lower part, mauve in the upper ; anthers violet ; pollen globose, white. Staminodes 3, without anthers. Base of stamens and staminodes minutely glandular-hairy. Style filamentous, white in the lower part, mauve above. Stigma bifid. Unripe capsule oblong, tip conical, shining, smooth. Seeds 4, disc-shaped, glabrous. [PLATE I.]

Very variable as to size and shape of leaves even on the same plant. In open situations the leaves are shorter, thicker, stiffer, and darker green on the upper surface, whilst when growing amongst other vegetation, they are longer, narrower, thinner and lighter green. In the latter surroundings the internodes of the stem are considerably thinner and longer. The flowers, too, vary a good deal as to size and shape of the corolla-lobes. On drying the upper side of the leaves turns black, the lower bluish-grey.

Locality : Below Godowli, 3 miles from Panchgani, W. Ghats of Bombay Presidency (Blatter Nos. 1, 2, 3, 5, 7 type, 4, 6, co-type). Was in flower during the first half of October 1927.

Crinum Eleonorae, Blatter & McCann, *sp. nov.* [Amaryllidacea Sectionis Brachynematis, similis Crino brachynemati, Herbert, a quo tamen differt collo robusto longo, staminum filamentis longioribus, antheris duplo longioribus, stylo quam filamentis multo longioribus].

Bulb ovoid or almost spherical, up to 20 by 13 cm., narrowed into a stout neck about 8 cm. long, clothed with old pale leaf-sheaths. Leaves appearing after the flowers, ensiform, with obtuse apex up to 60 cm. long and 5 cm. broad, not very firm, fairly thin, dark green, glabrous, with the margins entire. Scape lateral, up to 50 cm. long, reaching 2·5 cm. diam., cylindrical, but slightly compressed, green, tinged with purple. Flowers white, strongly scented up to 20 in an umbel, nodding. Bracts 2, broadly lanceolate, obtuse or acute, with broadly inflexed and thickened margin, 9 by 3·3 cm., green, tinged with purple outside, pale inside. Bracteoles linear, up to 9 cm. long, green, tinged with purple. Pedicels up to 1 cm. long, stout. Perianth funnel-shaped, tube green, tinged with purple, or greenish and becoming paler towards tip, up to 6·5 cm. long, cylindric at base, then becoming 4-sided with rounded angles; lobes up to 7·5 cm. long and 2·2 cm. broad, lanceolate, the inner ones sometimes oblanceolate, cuspidate, reflexed and slightly concave at the tip, with a longer cusp in bud, pure white, sometimes tinged with purple along the median line on the back; the buds are cream-coloured and the purple tinge is more pronounced. Filaments on the throat of the perianth-tube, free, filiform, purple, 1 cm. long; anthers in young buds yellow, then (whilst still in the bud) getting black and only yellow along the open slits, dorsifixed, up to 15 mm. long, oblong, twisted when dry. Style filiform, included in the tube, up to 5 cm. long, white in the lower part, purple above. Fruit not seen.

The anthers open in the bud.

Locality: Lingmala near Mahableshwar, open hill-sides and on both sides of the river above the Yenna Falls, also half-way between Panchgani and Mahableshwar (McCann Nos. 7, 8, 9, 10, type).

Forma purpurea.—McCann found specimens in the same localities with the perigone-segments oblanceolate, deeply tinged with purple on the dorsal side, and the perigone-tube with the bracts uniformly brown-purple. (McCann No. 11, type.)

In flower: End of April and beginning of May.

Iphigenia stellata, Blatter, *sp. nov.* [Liliacea, similis Iphigeniæ, indicæ A. Gray, differt tamen ab ea floribus duplo majoribus, petalis minime unguiculatis, oblongis vel oblongo-lanceolatis, vel oblongo-obovatis, non lineari-subulatis, mucronatis vel acuminatis].

Corm subglobose, 10–18 mm. in diam., narrowed into a short hypogæal neck, tunicate with light-brown membranous sheaths. Stem up to 10 cm. high, rigid to flexuous. Leaves alternate, 2–4, grass-like, sessile, the lower up to 12 by 1 cm., all about the same size, linear or linear-lanceolate, tip acute-mucronate, coriaceous, rigid, keeled, shining on both surfaces, base long-sheathing; midrib depressed on upper surface, nerves many, up to about 12, obscure above, very prominent beneath. Flowers various hues from pale to dark mauve, cream-coloured in bud, up to 7 in a terminal short raceme. Bracts linear or linear-lanceolate, resembling the leaves, up to 6 cm. long. Pedicels 12–20 mm. long, stout, thickened below the flower, deeply 6-grooved, each ridge supporting a petal. Perianth-segments up to 15 mm. long, up to 4 mm. broad in the middle, oblong or oblong-lanceolate, or oblong-obovate, mucronate or acuminate, not clawed, spreading. Stamens up to 5 mm. long, purple; filaments rigid, straight, slightly flattened on inner surface; anthers 1–1·5 mm. long, versatile, purple; pollen yellow. Ovary green, slightly shorter than the stamens, oblong-trigonous, 6-sulcate; styles 3, 2 mm. long, united at the base for about ⅓ their length, recurved, dark purple, stigmatic surface beginning with the curve of the styles; ovules ovoid-oblong. Capsule almost globose, or obovate or oblong-obovate, loculicidal, up to 8 mm. long, deep grooves between the carpels, shallow grooves on back of carpels, styles and stigmas persistent. Seeds subglobose or ovoid, 2 mm. long, slightly irregular, flattened on one side, umbonate, yellow testa very thin.

Like *I. indica* very variable and resembling it at first sight. Can always be distinguished by the much larger flowers and by the shape of the clawless petals.

Locality: Tableland of Panchgani, W. Ghats of Bombay Presidency, fairly common (Blatter P1 type), also found on Second and Third Tableland, on Tableland near Mahomedan School.

Was found in flower about the middle of June, 1925. There had been some heavy showers at the end of May and beginning of June.

Fruit noted about the middle of August.

Urginea polyantha, Blatter & McCann, *sp. nov.* [Liliacea similis Urgineæ indicæ, Kunth, sed recedit ab ea pedicellis brevibus nunquam deflexis, racemo denso multifloro, perianthio rotato, perianthii segmentis omnibus apice barbatis, staminibus brevioribus, stylo cylindrico, capsula apice truncata].

Bulb globose-ovoid, tunicate, pale, up to 5 by 4·5 cm., neck 3·5 cm. long, conical. Leaves appearing after the flowers, not observed. Scape up to 60 cm. high, up to 4 mm. diam. at the base, slender, rigid, slightly bent at tip, greenish to purple, dense-flowered. Flowers many, up to 50, about 1 cm. and less apart on the raceme up to 25 cm. long. Pedicels filiform, up to 6 mm. long, spreading in flower, ascending or appressed and almost double the length in fruit. Bracts deltoid, about 1 mm. long, often still visible in fruit. Flower-buds brownish-purple, obovate when very young, gradually becoming clavate. Perianth rotate, pale yellowish-green inside, with a broad brownish band along the centre outside; segments oblong, 5–6 mm. long, bearded at tip, outer ones 3 mm. broad, inner 2–2·5 mm. broad, obtuse. Stamens whitish, 2·5 mm. long; filaments flattened, getting very thin upwards; anthers versatile, cordate at base. Ovary oblong, 6-grooved. Style short, stout, uniformly thick throughout, 3-grooved. Stigma trigonous. Capsule up to 10 by 6 mm., broadly ovoid-oblong or broadly ellipsoid, truncate at tip, coriaceous, triquetrous, each carpel with an elevated groove in centre and with a slightly higher rib on margin. Cells 2–10-seeded. Seeds broadly ellipsoid, sometimes irregularly toothed at upper end, broadly winged, up to 6 by 5 mm., flat, shining black, seed without wing pear-shaped, flat.

Tetramerous ovaries have been observed. The flowers open before dawn and remain open till about noon. The perianth encloses the fruit till the latter reaches half the final size and then falls away.

Can be distinguished from *U. Wightiana*, Hook. f. by the much denser racemes, the shorter pedicels, the shorter and broader perianth-segments, the flowers not drooping, the seeds not being orbicular, and by the deltoid bracts.

In *U. coromandeliana*, Hook. f. the flowers are drooping and have longer pedicels, only the inner perianth-segments are bearded at the tip, and the style is obconic.

Locality: Amongst short grass on Tableland of Panchgani, W. Ghats of Bombay Presidency, 4,400 ft., very common in some patches, less common on slope of Tableland (Blatter and McCann No. 101, type).

Flowered from the middle of March to end of April, 1926.

Dipcadi Ursulae, Blatter, *sp. nov.* [Pertinet ad familiam Liliacearum; accedit ad Dipcadi montanum, Baker, a quo tamen recedit foliis latioribus, scapo tereti, bracteis ovatis longe-acuminatis quam pedicelli multo longioribus, pedicellis in vivo robustis minime filiformibus, perianthii lobis exterioribus quam tubus multo longioribus.].

Bulb globose, small, about 20 mm. in diam., tunicate, with many white fibres from the base. Leaves 4–5, leathery, 15-30 cm. long, up to 7 mm. broad, linear, plicate, grass-green, sheathing at the underground base. Scape green, terete, 15–30 cm. long, smooth, naked. Flowers when in bud in dense racemes of 6–12 flowers, ultimately the raceme becoming lax and reaching up to 12 cm. long. Bracts caducous, ovate, long-acuminate, 10–26 mm. long, reaching 2–3 mm. beyond the bud, centre green, margin in the lower part or the whole scarious. Pedicels 6–9 mm. long, stout, not filiform. Flower-buds dark pink-brown. Perianth 15 mm. long, 18 mm. across, slightly fragrant, the 3 outer lobes 9 by 3–4 mm., reaching 3–4 mm. beyond the tube, oblong, obtuse, recurved from about the middle and bent downwards, with 5 close, parallel nerves in the middle and with an indurated minutely hairy apex, lower surface pink-brown or greenish along the centre with the margin whitish, upper surface greenish or whitish or dirty-white, along the centre darker; the 3 inner perianth-lobes connate to about the middle, lower part oblong, 5 mm. long, tip 3–4 mm. long and as broad, recurved at right angle to tube, with an indurated apex which bears a few very minute hairs, lower surface whitish, along midnerve green or pink-brown, upper side white, or slightly tinged with green or pink-brown. Stamens attached to the perianth tube; filaments in their free part linear-lanceolate, flattened, 3 mm. long, white, bent twice at a right angle just below the anther. Anthers 2 mm. long, oblong, flat, thin, green, reaching the mouth of the tube, dehiscing longitudinally, introrsely. Ovary narrowly obovoid, trigonous, 5 mm. long, 2–2·5 mm. broad in the upper part, green, stalk 1 mm. long. Style 5-6 mm. long, stout, slightly thickened at both ends, papillose, especially in the upper half. Stigma indistinctly 3-lobed, 1·5 mm. in diam., not thicker than the style. Young capsule much longer than broad.

Locality: In grass on Tableland of Panchgani, W. Ghats of Bombay Presidency, 4,400 ft. (Blatter No. P74, type).

Flowered about the middle of August 1925.

Dipcadi saxorum, Blatter, *sp. nov.* [Pertinens ad familiam Liliacearum accedit ad Dipcadi concanense, Baker, differet tamen ab ea specie scapo necnon racemo multo longioribus, racemo ca 20-floro, bracteis late ovatis et longe acuminatis basi laciniolatis, perianthio parvo, segmentis ovato-obtusis, staminum filamentis brevissimis, stylo multo breviore, seminibus paullisper ellipticis vel fere orbicularibus].

Bulb tunicate. Scape about 50 cm. long, terete, smooth. Racemes up to 20 cm. long, rather lax, about 20–flowered. Bracts broadly ovate, long-acuminate, scarious, slightly fringed near the base about 7 mm. long. Pedicels stout, by ½ longer than the bracts. Perianth 12–14 mm. long, tubular, slightly trigonous, the 3 outer lobes connate for ⅓ their length, linear-oblong, obtuse, recurved from about the middle with a thick, glandular tip, the 3 inner connate for almost ⅔ their length, 3 mm. broad, ovate-obtuse, with a recurved and slightly thickened tip, all lobes whitish with an olive-coloured central band. Filaments about 1 mm. long, slightly flattened ; anthers 3 mm. long, versatile, yellow. Pistil 10 mm. long. Ovary 5 mm. long, trigonous, clavate, shortly but distinctly stipitate ; style very stout, 5 mm. long, minutely granular upwards ; stigma slightly thicker than style, 3-lobed. Capsule broader than long, deeply 3–sulcate, loculicidally 3-valved, membranous, stipitate, stalk stout, about 2·5 mm. long ; cells 5-seeded, seeds slightly elliptical to nearly orbicular in outline, reaching 5 mm. diam., compressed, with a raised margin, the lowest and topmost in each cell plano-convex.

Locality : Rocky places above the Kanheri Caves in Salsette, about 1,000 ft., Bombay Presidency (Blatter and Hallberg No. S1, type)

Flowered in August 1917.

BIRDS OF PREY AND THEIR USES

BY

C. H. Donald, F.Z.S., M.B.O.U.

(*With 4 plates*)

From time immemorial the Raptores, as a class, have been looked upon as ' vermin ' to be destroyed at sight. The gamekeeper has no use for them whatsoever, the poultry farmer (particularly in this country), wages continual war on them, and even the Memsahib, and her cook, chiefly the latter, have given of their best mutton-chops or beef ' i-stakes ' to satisfy the hunger of some marauding kite.

In England, even the little kestrel is persecuted by the gamekeeper as a destroyer of pheasant chicks and partridges, and in this country, as in parts of Ireland, ' the Hawk ' is anathema to all who have anything to do with the preservation of game.

Yet, there is another side to the story, and if we go into the subject a little deeper than what appears on the surface, and consider the habits of the various species, one begins to wonder what we should do without them ?

It, of course, must be thoroughly understood from the first that no bird of prey will ever refuse a good opportunity of taking an easy prey, such as a wounded or sick bird, or one in which the flight is defective from an injury to the wing or otherwise. A White-eyed Buzzard (*Butastur teesa*) who has spent his life catching rats, frogs and insects, will immediately bestir himself should a maimed partridge appear in the open within the range of his vision, whereas normally, a whole covey might feed with impunity in a field within fifty yards of his perch without his taking any notice of them or the partridges of him.

Let us now try and see to what extent the birds of prey, as a class, deserve this unenviable reputation.

From Mr. Stuart Baker's *Hand List of the Birds of India* we find there are 105 varieties of diurnal birds of prey. This represents almost one-sixth of the world's total number, so India is well supplied.

Of this number many are winter visitors which arrive in the autumn and disappear in the spring. Some are to be found in the hills and not in the plains, and *vice versa*, whereas many which are found in the north are wanting in the south, and southern birds are very often unknown in the north.

From this it is pretty evident that no hard-and-fast rule can be laid down for any particular locality, or even Province, and if we are to discover to what extent the Raptores are injurious to our game preserves, we must first find out what species are normally found in that area.

To begin with let us make a list of the genera to be found in the whole of India, from which we must eliminate those which are harmless, and I have no doubt that many of our members will probably be surprised at the result.

The Order Accipitres is divided into three families, viz. Pandionidæ, Gypidæ and Falconidæ, the last being again subdivided into two sub-families, Gypaëtinæ and Falconinæ. It is unnecessary here to go into details regarding every species or variety, but we can enumerate the genera and state how many species each is comprised of, and these genera are :—

1. Pandion (Osprey), one; Vultures (*Ægypius, Torgos, Gyps, Pseudogyps,* and *Neophron*) in all ten species : The Lammergeier (*Gypætus*), one ; True Eagles (*Aquila*), six ; Hawk-eagles (*Hieraëtus, Lophotriorchis, Ictinaëtus, Spizaëtus*), eleven ; Serpent Eagles, Buzzards, Fishing Eagles, Kites, Harriers, Honey-Buzzards, Bazas and Falconets, in all forty-five species and varieties, beginning with No. 1621 *Circaëtus gallicus* to No. 1654, *Buteo b. japonicus* ; No. 1670 to 1675 and again from 1692 to 1695.

This then leaves us with the hawks and falcons, i.e. *Astur, Accipiter* and *Falco*, which between them account for thirty-one species and subspecies.

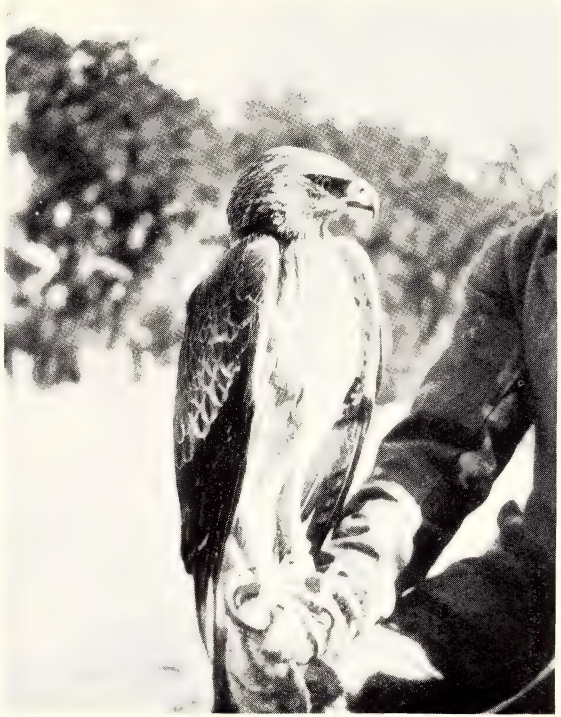
Now out of this lot the following might safely be eliminated without further consideration as not coming within the range of game destroyers, viz. Osprey one, Vultures ten, the miscellaneous assortment from Serpent Eagles to Falconets forty-five, and the Lammergeier one.

That is fifty-seven species, or over one half of the birds of prey of India.

From this it must not be assumed that none of them ever catch a game bird, as harriers catch quail or even a very occasional partridge, and a fishing-eagle might often be seen flying off with a duck (though probably never one that has not been in some way maimed), but as a normal thing none of these birds are game killers and the majority are absolutely incapable of catching any game bird in full possession of its power of flight.

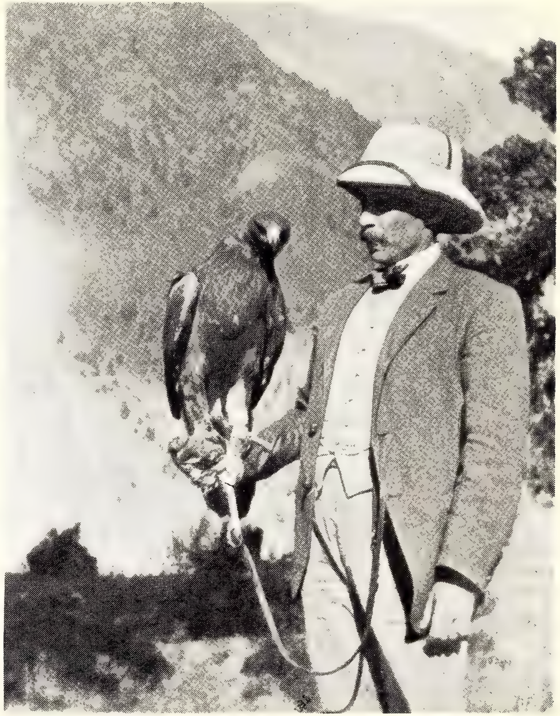
To this list we can add several others. The genus *Aquila* contains six species of big powerful birds, but of these six only one, the Golden Eagle (*A. c. daphanæ*) is a hunter, or capable of catching any game bird. The remaining five might safely join the list of the 'harmless'. The hawk-eagles must all remain in the list of suspects, and in fact are more or less, rather *more* than less all distinctly injurious, with the possible exception of *Hieraëtus pennatus* and *Ictinaëtus m. perniger*.

Among the hawks and falcons we have a number of keen hunters, but how many would normally take a bird as big as a partridge if smaller fry is available ? Very few among the hawks, at any rate. From the falcons we can ignore the merlins, hobbies and kestrels as being too small to worry about, which leaves us with six falcons which are all capable of doing considerable damage.



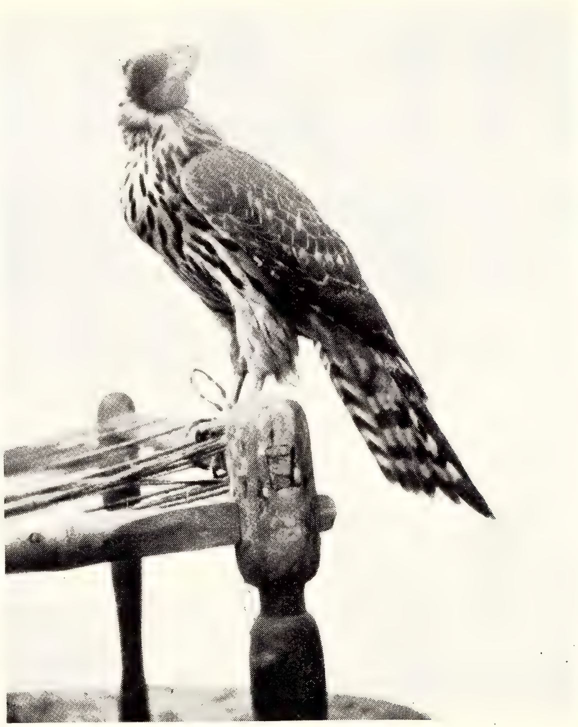
BONELLI'S EAGLE
(*Hieraëtus fasciatus*)

Very destructive to game.



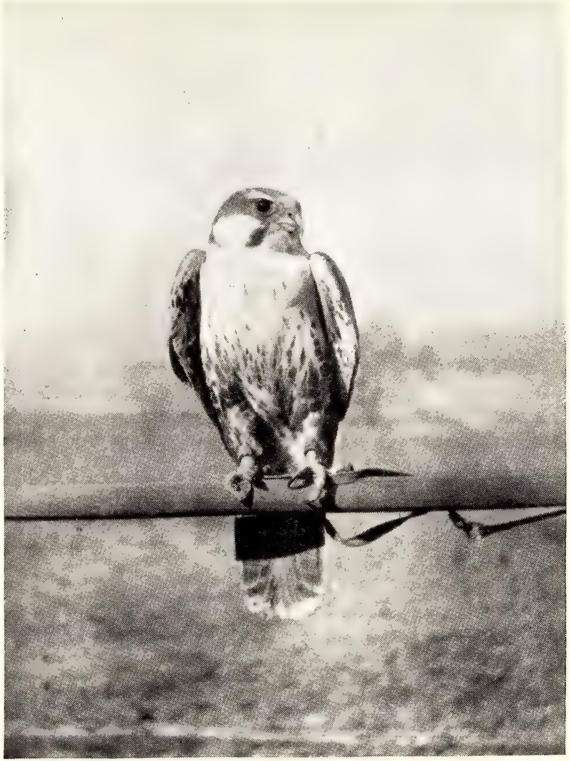
THE GOLDEN EAGLE
(*Aquila chrysaëtus daphanœ*)

Destructive to hill game in Autumn and Winter.



THE EASTERN GOSHAWK
(*Astur gentilis schvedowi*)

Very destructive in the hills.



THE LAGGAR FALCON
(*Falco jugger*)

Might become destructive in a particular locality.

This reduces the list to one eagle, nine hawk-eagles, six falcons and perhaps as many hawks, say a little over a score of birds in all, out of a total of 105.

Having arrived at the number that should be watched as probable destroyers, the next question for the game preserver to consider is how many of these ever visit, or are ever likely to visit his particular preserves. For this purpose we can divide them into two classes, those that will be found in the plains, and those that live in the higher ranges of the Himalayas. Of course, the list will vary with each province, but if for the sake of argument we take the Punjab, which I happen to know best, we should arrive at approximately the following conclusion. I say approximately because stragglers and wanderers might turn up anywhere.

Varieties	*Hills*		*Plains*
Golden Eagle	1		nil
Bonelli's Eagle	1		1 (up to 8000′)
Changeable Hawk-Eagle (rare)	nil	(low hills)	1
Hodgson's Hawk-Eagle	1		nil
Goshawk	1		nil
Shikras and Sparrow Hawks	5		5
Falcons	4		6
	13		13

The above then is a rough list of what might reasonably be expected to appear in either the hills or the plains of any district in the Punjab. It includes such birds as the Shanghar and Red-capped falcons, which are rare at best, whereas many species are restricted to particular tracts and are by no means universally met with throughout the Province.

This means, that in a province like the Punjab we need only bother about some thirteen species of the Raptores as being *likely* to destroy our game in any particular locality, and if each province was taken separately, the result would be more or less similar.

Having arrived at the above conclusion for the province, let us see how the thirteen birds effect our particular area, be it in the plains or in the hills, so let us start with a game preserve in the plains ; what do we find :—

(*a*) *Bonelli's Eagle.* They hunt in pairs and are undoubtedly destructive.

(*b*) *Booted Eagle.* Rare at best and will seldom take a bird as quick on the wing as a partridge.

(*c*) *Changeable Hawk-Eagle.* Only in the vicinity of low hills, but very destructive where found.

(*d*) *Shikras and Sparrow Hawks.* Not normally destructive to birds the size and strength of a partridge, but will take young chicks and cheepers.

(*e*) *Falcons.* If near water, the Siberian Peregrine will be a constant visitor in the winter, but partridges are only in danger when feeding far from cover.

(*f*) *The Indian Peregrine Falcon.* Not very common and birds only in danger when away from cover.

(*g*) *The Laggar Falcon.* Hunts in pairs and a pair may become attached to a preserve and do considerable damage when cheepers are about.

(*h*) *The Saker Falcon.* Is not likely to be found over scrub jungle, and prefers open plains and sandy tracts. Can be ignored.

(*i*) *The Red-capped and Shanghar Falcons.* Too rare to matter.

It will thus be seen that an intelligent interest in the doings of the Raptores which frequent any area is all that is necessary to find out the real culprits that are doing, or apt to do, damage but to call the whole family 'vermin' and try to exterminate them is the surest way of ruining any game preserve, as I shall endeavour to show.

Real enemies of ground game.

The next question is, when does ground game need most protection? Obviously in the nesting season.

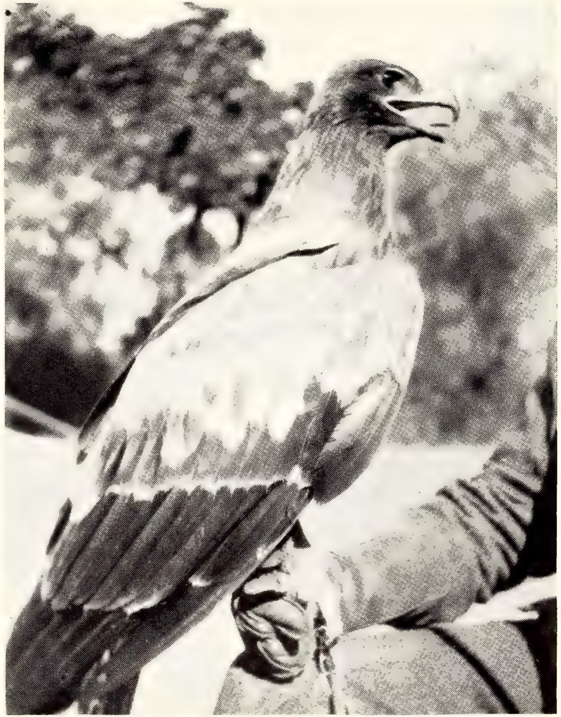
During the nesting season what is its worst enemy? Here we have a number of things to contend with such as rats, mongooses, the larger snakes, monitor lizards, and to a smaller extent foxes, cats and perhaps jackals. Of these, again, which are the worst? Monitor lizards, rats (because of their numbers), snakes and mongooses. The last, however, might be allowed considerable latitude because of the good they do in keeping down snakes and rats. Snakes also eat rats, but the actual number of rats killed by snakes in the year must be, at best, comparatively small and almost negligible.

Any of the above-mentioned will wipe out an entire clutch of eggs in a few moments. It would take a hawk or a falcon, even if it took to a game diet and ate nothing else, a week or ten days to accomplish such a result.

On the other hand what keeps down rats and snakes, besides a mongoose, cats and foxes? The birds of prey. There is not a single bird of prey (except vultures), that will not catch and eat a rat, given the chance; not even the noble Peregrine or the mighty Golden Eagle, will refuse the tit-bit, whereas the majority of them practically live on them. Remove this host from any area and the result will probably spell disaster.

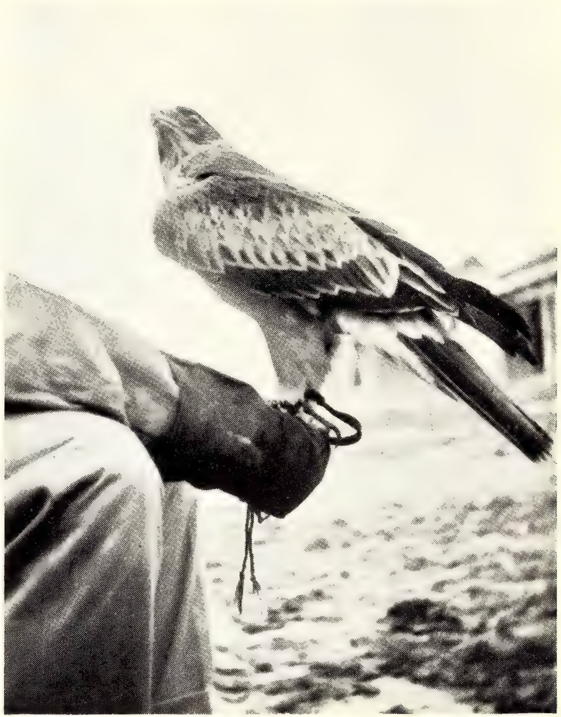
I have recently been through the best partridge preserves in the province, during the gun dog trials in Patiala and Jind, and the fact was very noticeable that we came upon patch of jungle where the birds were extremely plentiful, in fact too plentiful for the peace of mind of the working dogs, whereas we also came upon patches where for half an hour at a time, not a bird was flushed. This fact led me to keep an eye on the nature of the ground and I noticed that many of these barren beats were infested with rat holes, and the mounds of the mole-rat were much in evidence. Was this a coincidence, or does it bear out my theory that rats are one of the biggest enemies that ground game has?

Throughout the six days, four in Jind and two in Patiala, that I was there, I also kept a close eye on the birds of prey we encountered, and these are the species I saw:—Shikras, in plenty. One chased a partridge that had been very slightly wounded for



THE EASTERN STEPPE-EAGLE
(*Aquila nipalensis nipalensis*)

An excellent rat killer



THE BOOTED EAGLE
(*Hieraëtus pennatus*)

More friend than foe.

THE KESTREL
(*Falco tinnunculus*)

Lives on rats, mice and insects ; very occasionally kills a bird.

THE WHITE-EYED BUZZARD
(*Butastur teesa*)

A ratter pure and simple.

quite a long way, but failed to catch it. I never saw another one attempt to chase, though I twice saw partridges fly into the open and pass a tree, into which a shikra had gone a few minutes before, without the latter taking any notice. One pair of Red-headed Merlins, two pairs of Laggar Falcons, several White-eyed Buzzards, a couple of Long-legged Buzzards, and a larger number of Tawny and Steppe Eagles, and one Imperial Eagle. A Steppe Eagle carried off a partridge that had been shot and was, in turn, pursued by no less than four others and an Imperial, but which eventually got the booty I did not discover. I noticed harriers on several occasions, and a very fine adult Spotted Eagle took up a commanding position over the water on which the water test took place, but ' moved on ' as soon as the first shot was fired. I saw no sign of any of the ' nobler ' falcons and was somewhat surprised not to see a single Bonelli's Eagle.

The presence of eagles and buzzards is a fairly good indication that rats are numerous and hunting (of rats) good.

In the hills, what is the worst enemy game birds have to contend with in the breeding season ? The Jungle Crow first and foremost, and the Indian Marten. Then possibly foxes, cats and such like. During the autumn and winter the Golden Eagle takes considerable toll, and the Hodgson's Hawk-Eagle and the Goshawk at all times, but the Goshawk is by no means as common as it used to be, and the Hodgson's Hawk-Eagle is curiously given to certain localities and completely wanting in others. It is very common, for instance, in Bhadarwar and parts of Chamba and very rare in Kangra. Yet it is very common again in parts of the Simla Hills such as the Jubal and Taroach States, but rare on the Sutlej watershed. This species is particularly destructive to pheasants of all kinds and his method of hunting does not give them the smallest chance of escape.

The Golden Eagle, on the other hand, does not appear to touch game during the breeding season and every nest I have examined (and I have taken four youngsters from their nests, as far apart as one in Kashmir, two in Bushahr State (Simla Hills) and one in Tehri Garhwal), has contained more remains of crows than anything else.

The reason for this is not hard to seek. He is a typical falcon in his way of hunting, and prefers the open. His long wings are all against his hunting among trees, and unless pheasants can be flushed for him and rise above the trees, he is powerless. During the summer months most pheasants keep to thick cover, except Snow-cock and a few Monal which go out on to the Alpine pastures to feed. At this period the Golden Eagle has his work cut out providing food for a shrieking youngster in the nest, and it is not quality he seeks but quantity, and there is no lack of crows.

Crows, with dozens of youngsters, go in large flocks to roost among the oaks at high levels in the evening and come down in the morning, and the eagle has no difficulty in getting as many as he wants. In this respect he does a great deal of good, but there is no denying the fact that any and every pheasant which has the temerity to feed out in the open, in the autumn when the young eagle accompanies its parents, is looking for trouble.

Bonelli's Eagle, though unlike the other hawk-eagles in his method of hunting, does considerable damage, particularly among Chukor. They always hunt in pairs and are very persistent in their attack.

Though we have already reduced the possible destroyers of game to thirteen, it must be remembered that this number is the maximum of what might reasonably be expected to be seen over any particular locality, and it can be very considerably reduced for really practical purposes. For instance, in the plains, the possibility of five species of shikras and sparrow-hawks appearing in any one locality is very remote. Then again, during the most important period of game preservation, viz. the breeding season, at most two species of falcons will be found, the rest having left the country.

Thus the game preserver need only trouble himself with a very small percentage of the total number, and then only if he finds that some particular individuals have regularly attached themselves to the vicinity and taken to a game diet. Rather than shoot the wrong birds it would perhaps be better to shoot none at all.

After all if we look at it in another way we find that the commonest hawk in the plains of India, and the hills too for that matter, is perhaps the Shikra. It takes considerable toll of the smaller birds, and so do Red-headed Merlins, and yet do we find any diminution in babblers, sparrows and our host of little garden birds ?

Most of us can probably name various places where game was plentiful twenty or thirty years ago, inspite of the birds of prey, which had been there with the game from time immemorial. I can even now find my way to places in the Himalayas where Monal and all the other pheasants are extremely numerous, and appear to thrive inspite of the presence of Golden Eagles, Goshawks and the other birds of prey. But these are places where there is not a village within twenty miles and the people in those villages have not yet aspired to gun licenses.

It is man, with his guns, nets and nooses who does most of the damage. Before he came on the scene as a destructive agent, Nature preserved her balance. Now since man has upset the balance it behoves him to remedy the evil that he has brought about, if we would preserve our game, and to do that it is necessary to consider the whole position intelligently, and discover the real agents of destruction and wage war on them, and not seek to destroy an entire family simply because one member has proved a game-destroyer.

Is it not time that the Society took up the question of not only game preservation but the preservation of our fauna generally ? India is dependent on its agriculture, and the thousands of birds, of which the zamindar knows nothing and cares less, are one of the main factors which protect his crops. Out of over 2,000 odd species to be found in the Indian Empire, a good sixty per centum are insectivorous and therefore the zamindar's staunch allies. There are only a very small percentage that are actively destructive. Under the Arms Act we have numbers of would-be shikaries who are out to shoot something for the sake of shooting, in season and out of season.

Under the Wild Birds and Animals Protection Act, Government can stop the shooting of any particular species, but cannot declare a general close season. Is this of any use ? You cannot do anything to a man unless you actually catch him in the act of shooting a protected bird, and what is to prevent him shooting a dozen protected birds when no one is near, and producing an ' unprotected ' bird when questioned ?.

A general close season when the carrying of a shot gun is an offence under the Act is essential, except in the vicinity of crops. Crop protection licenses might be issued free of charge, but the moment the man is found using his gun outside his crops the license should be cancelled and the arm forfeited.

Something on these lines will have a very beneficial effect but the present system spells extermination of game within the next two decades or so.

The rules and regulations of the Forest Acts can only apply to protected forests, but what about the rest of the country where the ' would-be ' shikari, to say nothing of the many criminal tribes with their nets and nooses, can destroy what they like with impunity ?

A NOTE ON THE BIRDS OF THE PESHAWAR DISTRICT

BY

REV. F. S. BRIGGS AND B. B. OSMASTON, M.B.O.U., I.F.S. (RETD.)

(*With a map.*)

The following notes on the birds of the Peshawar District have been combined from the observations of the Rev. F. S. Briggs and Mr. B. B. Osmaston by Mr. Hugh Whistler. The former spent six years at Peshawar, from 1920 to 1926. The latter was there merely for a single cold weather from October 27, 1925 to March 27, 1926, but the shortness of his stay was compensated for by the care with which he made a collection of skins to identify the cold weather avifauna. These skins have been enumerated under their respective species, and the identification of the various racial forms is largely due to them. It is, however, realized that this list of Peshawar birds cannot be considered complete. It is proffered both as a record of the notes made by these two observers, and as a groundwork for a fuller investigation of the avifauna of what, from its position, will undoubtedly prove to be one of the most interesting and prolific districts of India to the students of the palæarctic area.

Peshawar is situated in the north-west corner of British India, N. Lat. 34°, E. Long. 71½°, in a wide plain traversed by the Kabul River, and surrounded by hills.

This valley or plain measures some forty-eight miles from east to west, and about thirty from north to south. It is roughly level, at an altitude of about 1,100 feet above the sea.

For six or seven miles in all directions from Peshawar the valley is very fertile owing to a very complete system of irrigation by canals from the Kabul and Bara Rivers, and magnificent crops of wheat, barley, maize, rice and sugar-cane are produced.

Outside the irrigated area the country is virtually a desert, owing to the shortness of the rainfall, Peshawar being outside the area served by the South-west Monsoon.

These dry desert areas bear little or nothing in the way of trees, vegetation being restricted to a sparse growth of thorny shrubs. Woods and tree-growth are restricted to the irrigated tract, including Peshawar Cantonment, which is well wooded with a variety of trees. Elsewhere in the irrigated tract we find extensive orchards of pears, quinces, peaches, oranges and pomegranates, and along streams willows and mulberries, with roadside avenues of tamarisk and sheesham.

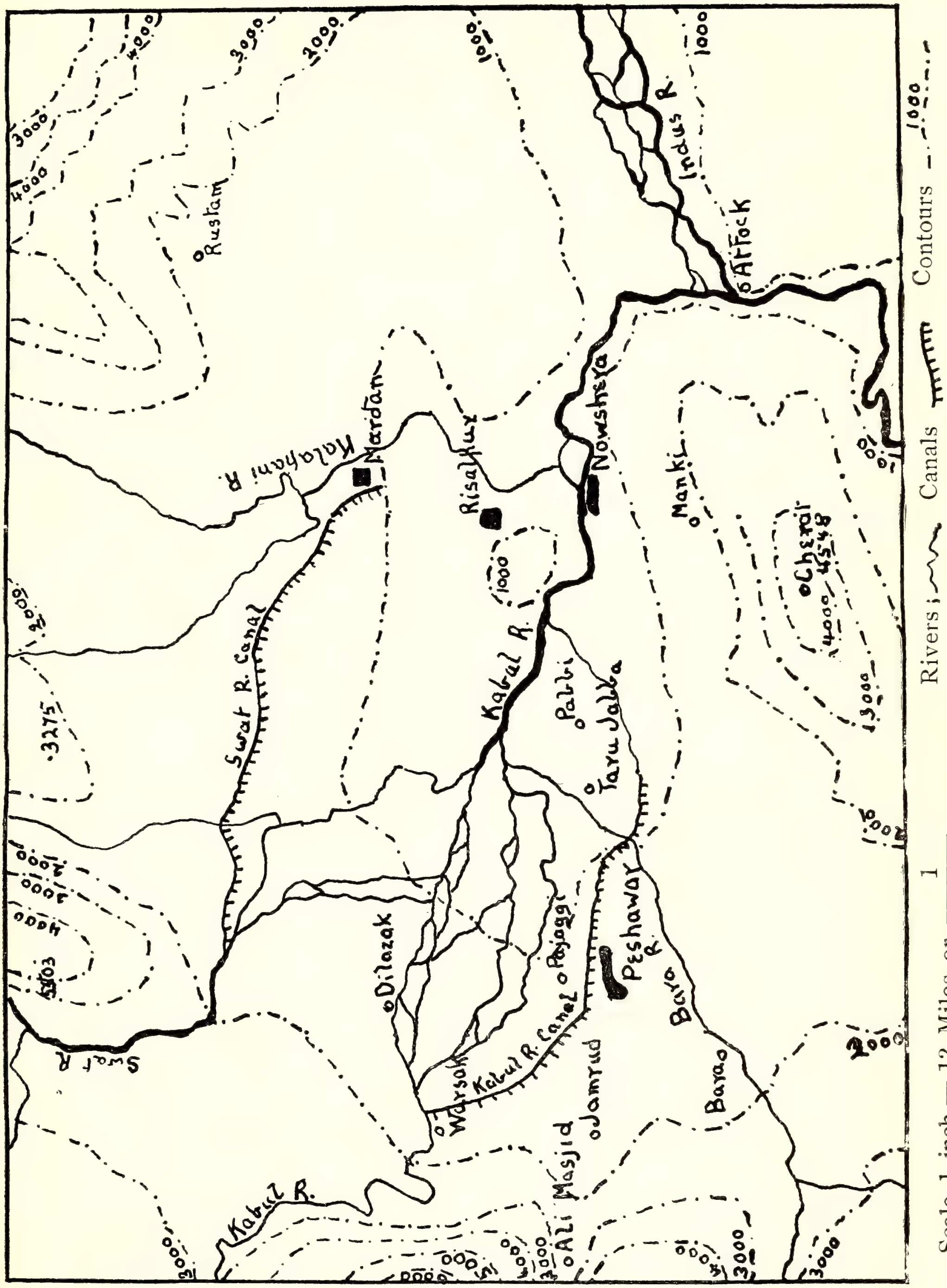
The climate is one of extremes. The winter months, from October to March, are cold, with regular night frosts from December to February, but with plenty of warm sunshine in the day. The summer heat is severe and prolonged, and frequently the temperatures registered at Peshawar are as high as, or even higher than those in any other part of India.

The country round Peshawar falls naturally into three classes :—

1. The irrigated tract, including Peshawar itself and its immediate surroundings, characterized by field crops and a considerable quantity of tree growth.
2. The dry, desert country, surrounding the first, and extending to the hills.
3. The swamp areas, found scattered in (1), and also including very large beds of bulrushes, reeds and tall grass in the neighbourhood of the Kabul River and its branches and backwaters. Unfortunately, from the point of view of the ornithologist, a very large proportion of the reeds are cut and dried for fuel and other purposes just at the time when they would provide nesting-sites for several species of birds.

The birds which affect these three types of country are mostly quite distinct.

PESHAWAR VALLEY


Rustam
Mardan
Kalapani R.
Risalpur
Nowshera
Attock
Indus R.
Swat R. Canal
Kabul R.
Pabbi
Taru Jabba
Manki
Cherat
4548
Dilazak
Peshawar
Peshawar R.
Pajaggi
Kabul R. Canal
Warsak
Jamrud
Ali Masjid
Bara R.
Bara
Swat R.
Kabul R.
3275
4103
1000
2000
3000
4000
Rivers;
Canals
Contours
1000

Scale 1 inch = 12 Miles or $\frac{1}{3,760,320}$

1. **Corvus corax** (L). The Raven.
Although rarely seen in Peshawar itself the Raven is found in winter througout the Peshawar Valley, being common a few miles out, for instance in the more open stretches round Nowshera and Risalpur, near Jamrud, and along the Khaibar Pass and Kohat Roads. During the hot weather it is only to be seen in the valley on occasional cool days following rain, but it is at this season very numerous at Cherat, and a few may be seen in the Khaibar Pass. A pair build regularly on the cliffs on the Marble Rocks, between Nowshera and Risalpur. The nest contained four newly hatched young and two infertile eggs on March 6,1923, and three fresh eggs on February 8,1925. The birds which laid in this nest were certainly *C. c. laurencii,* but some of the Ravens seen in the valley and more especially in the Khaibar Pass are very rusty in appearance, and it is possible that *C. c. ruficollis* either breeds in the Pass, or wanders into the valley. No specimens were, however, procured.

2. **Corvus coronoides intermedius** (Adams). The Himalayan Jungle Crow.
♂ January 2, 1926, ♂ February 7, 1926, Peshawar. A single bird was shot by Osmaston at Peshawar on February 7, feeding on the carcase of a buffalo. There is some doubt as to whether it is this species or the Carrion Crow (*Corvus corone*) which Briggs noticed as a regular but never numerous winter visitor to the Peshawar Valley. He records it as always commoner in March and April than at any other time, and then apparently migrating in a westerly direction as small parties may be seen making their way up the Khaibar Pass.

3. **Corvus frugilegus** (L). The Rook.
♂ ♀ February 5, 1926. Peshawar. Abundant winter visitor, arriving towards the end of October (earliest date October 23), and gradually becoming more numerous ; practically all are gone by the end of March ; latest date observed April 5. During the daytime the Rooks feed in the irrigated fields, and are then rarely seen in Cantonments or villages. They collect, however, in vast flocks at night to roost in the avenue trees in the Cantonments of Peshawar and Mardan, though none seem to sleep in Nowshera or Risalpur.

4. **Corvus cornix sharpii.** (Oates). The Eastern Hooded Crow.
♂ December 21, 1926, ♀ January 21, 1926. Peshawar ; ♂ December 29, 1925, Pabbi. A regular winter visitor ; earliest date October 23, latest date March 23. It is found in pairs, or rarely in small parties, often associated with Rooks, and keeps almost entirely to the wilder, more open, and barren parts of the valley specially in the vicinity of swamps or the river. It is the wildest and most wary of all the local crows.

5. **Corvus splendens zugmayeri** (Laubm.) The Sind House-Crow.
♂ December 29, 1925, Peshawar. Exceedingly common and resident in and around Peshawar. It roosts separately from the Rooks. Eggs are mostly laid in the first week of July. In February, 1921 there appeared to be an epidemic among the species, and considerable numbers fell dead from their sleeping-perches.

6. **Corvus monedula sœmmeringii** (Fischer). The Eastern Jackdaw.
♀ February 5, 1926, Peshawar. A winter visitor from November to early March, varying in numbers greatly from year to year. In the winter of 1920–21 they were numerous, and very numerous again in the winter of 1925-26, whereas in the winter of 1921–22 Briggs only saw them once, namely on January 1. They feed in the fields with the Rooks, and also roost with them.

7. **Nucifraga multipunctata** (Gould). The Larger Spotted Nutcracker.
A straggler, probably of this species, which is the form found on the Sufed Koh to the west and in Hazara to the north, was seen by Briggs in Peshawar on April 23, 1920. The previous night had been very stormy.

8. **Parus major kaschmiriensis** (Hartert). The Kashmir Grey Tit.
♀ October 31, 1925. ♀ November 6, 1925, Peshawar. A fairly common winter visitor to the Peshawar Valley ; earliest date October 21, latest date March 30. It keeps chiefly to the wooded areas.

9. **Parus monticolus** (Vigors). The Green-backed Tit.
A winter visitor, less numerous than the last species. Earliest date October 13, latest date March 14.

10. **Ægithaliscus concinnus** (Gould). The Red-headed Tit.

A party of about six were seen by Briggs at Cherat about 4,500 on August 22, 1920.

11. **Argya earlii** (Blyth). The Striated Babbler,

Rather rare, but probably a resident. A nest with fresh eggs was taken by Briggs in swampy ground at Rashkai near Mardan, on May 29, 1922.

12. **Argya caudata.** The Common Babbler.

♂ ♀ November 16, 1925. ♂ ♀ November 18, 1925. ♂ December 14, 1925, Peshawar.

A common resident, numerous in the long grass and tamarisk near streams, and, as elsewhere, found in loose parties. In winter it is more numerous in gardens than in summer. While breeding it shows a preference for evergreens. Fresh eggs found between March 21 and August 19 but mainly in April.

13. **Molpastes hæmorrhous intermedius** (Jerdon). The Punjab Red-vented Bulbul.

♂ ♀ November 16, 1925. Common in Peshawar and in the surrounding woods. Doubtless resident, but Briggs notes :—' In the unusually dry and hot summer of 1920, Red-vented Bulbuls became scarce about the middle of July and remained so till the evening of September 29. On that evening, about seven o'clock, a large flock of white termites appeared in Peshawar, with numbers of Bulbuls in pursuit of them. For about twenty minutes not less than thirty Bulbuls were busily employed in my garden feeding on the termites which they caught in the air after the manner of Flycatchers. The next day Bulbuls seemed to be about the same numbers as they had been the previous winter, and I noticed no great fluctuation in numbers afterwards.' Fresh eggs found between March 13 and July 12.

14. **Molpastes leucogenys leucogenys** (Gray). The White-cheeked Bulbul.

♂ ♂ November 13, 1925. ♀ November 18, 1925. ♂ December 7, 1925. ♂ December 13, 1925.

15. **Molpastes leucogenys humii** (Oates). Hume's White-eared Bulbul.

♂ ♀ ♀ January 11, 1926. Twenty miles south-east of Peshawar.

Osmaston collected a nice series of ten of these Bulbuls in the winter of 1925–26, and states that they are common, and found to some extent in the dry tracts, though mainly in the irrigated area. He suspects that they may be a winter visitor. Briggs' longer observations enable him to amplify this as follows :—' Very numerous in winter, especially in the latter part. In the summer this bird retires from the lower parts of the valley to the hills surrounding it. I have found them breeding at Attock at about 1,000 feet, below Cherat at about 2,000 feet and near Ali Musjid at about 2,500 feet. It is surprising that the White-cheeked Bulbul of the Peshawar Valley should be *leucogenys* and not *humii*.' He further adds that he saw two Bulbuls outside Peshawar on the Jamrud road on January 18, 1920, which he identified as *M. l. loucotis*.

An examination of Osmaston's series shows that all the specimens from Peshawar are clearly *M. l. leucogenys*, and we are justified in describing that form as a regular and common winter visitor to Peshawar. Three birds, however, obtained in the dry foot-hills 20 miles to the south-east of Peshawar are closer to *M. l. humii*, and doubtless represent the resident form. We have been compelled for the identification of these birds to examine the British Museum series as well as thirty birds in Mr. Whistler's collection, as the account of these forms in the second edition of the Fauna is not very satisfactory, and superficially they are difficult to understand owing to the amount of variation in the individual. It may be as well, therefore, to explain the position.

The Yellow-vented Bulbuls of North-west India form an excellent example of a species, divided into subspecies, and connected by intermediate forms. Gray in 1830 described the hill bird from Darjeeling and in this species, curiously enough, although the bird is so variable in the north-west generally, birds from the Eastern Himalayas are precisely similar to birds from the Western Himalayas as *leucogenys*, while Gould in 1836 described the plains bird as *leucotis* ; its type locality has since been restricted to Karachi, Sind.

If Sind and Himalayan birds alone are contrasted, we have two very distinct birds, which might well rank as full species, with no danger of confusion between them.

Leucogenys is a large bird with a long, comparatively slender bill, compared with the smaller *leucotis* and its short bill.

Leucogenys : Bill from skull ♂ 18–20 mm. ; ♀ 17·5–19·5.
Wing ♂ 88·5–98 ; ♀ 88–96·5
Leucotis. Bill from skull ♂ 17 mm. ; ♀ 16·5–17 :
Wing ♂87–88 ; ♀ 81·5–85

In *leucogenys* the crest is so long and so curved forward over the beak that it resembles a fool's cap in shape—a peculiarity most marked in life ; the colour is hair brown, each feather being narrowly edged with greyish white. There is a white line above the lores. The upper plumage is earth-brown tinged with olive-brown and even olive green. The under tail coverts are bright sulphur yellow.

In *leucotis* the crest is so short as to be almost non-existent ; it is entirely black, and there is no white line above the lores. The white cheek-patch is twice as large as in the other bird, and the black on the throat is more sharply defined, contrasting with the whitish lower plumage. The upper plumage is plain fawn brown. The under tail coverts are rich saffron yellow.

But between these forms a regular gradation may be found in the triangle of country which extends north-west of the Salt Range to the Afghan ranges and to the Himalayas. The elevation here runs between 1,000 and 3,000 feet and the Bulbuls from this area approximate more closely to *leucogenys* than to *leucotis*, in that all have the under tail coverts bright sulphur yellow, and in their size. The crest and loral line are variable, as is also the colour of the upper parts.

It so chances that in 1889 Oates picked out a single bird from this intermediate area, from Jalalpur, Jhelum District, on the southern border of the triangle, and made it the type of his *Molpastes humii*, so this name is available for the intermediate forms. It must be remembered, however, that this race *M. l. humii* being a true ' intermediate is variable, approximating on either side to the two races which it connects. This approximation follows fairly definite lines. Birds from the Jhelum Salt Range agree fairly closely with Oates ' type, which in its shorter black crest without pale edging and with practically no trace of the white loral line, in the size of the white cheek-patch, and in the fawn coloured upper plumage, is very close to true *leucotis*. Birds from Kohat and Bannu are in turn closer to *humii* as are Osmaston's three birds from the dry foothills about Peshawar. At Attock, Campbellpur, and Rawalpindi, however, we find, as might be expected, that the birds are much closer to the true *leucogenys*, which also probably in winter descends from the Himalayas and mixes with them. Indeed they are as close to *leucogenys* as Oates' type is to *leucotis*, and a determined ' splitter ' might name them so as to make two groups of races merging into one another.

This explains the situation at Peshawar. The resident bird belongs to the drier areas and low ranges, and is of the intermediate race *humii* ; it is, however, obscured in winter by a regular immigration to the fertile irrigated area of the Himalayan race, *leucogenys*.

16. Certhia himalayana (L). The Tree-Creeper.

♀ November 20, 1925. ♀ November 24, 1925, Peshawar. A fairly common winter visitor, found in avenues, woods, and gardens. Earliest date seen October 17, 1925, latest date March 14, 1925. Briggs found one caught in a spider's web and entirely unable to free itself.

17. Tichodroma muraria (L) The Wall-Creeper.

A numerous winter visitor to the sandy nullahs and rocky gorges that surround the Peshawar Valley, such as the Khaibar at Ali Musjid, Attock and the Kalapani River at Risalpur. Peshawar itself is not suitable to its requirements.

18. Saxicola caprata bicolor (Sykes). The Pied Bush-Chat.

♂ December 30, 1925, Peshawar. Mainly a summer visitor, though a few birds winter in the valley. The earliest and latest dates for the mass are February 28 and October 1. In the valley eggs may be found commonly between April 7 and May 17, but Briggs found two nests with eggs on the point of hatching on July 11, 1922. The majority of the birds of this species appear, after breeding in the valley, to take their young, as soon as they can fly, to the lower hills round the Peshawar Valley.

19. **Saxicola torquata indica.** (Blyth). The Indian Stone-chat.
♀ November 9, 1925, ♀ November 20, 1925, ♂ November 26, 1925, Peshawar. Mainly a spring and passage migrant, noted by Briggs as passing in spring between March 17 and May 24, and in autumn between September 24 and October 10. A few however, remain in winter.

20. **Saxicola torquata leucura** (Blyth). The White-tailed Stone-chat.
♂ December 12, 1925, Peshawar. Osmaston collected a pair at Peshawar on December 9, 1925, and his statement that a Stone-chat is not uncommon throughout the winter, especially in grassy areas near swamps probably refers partly to this race.

21. **Œnanthe picata** (Blyth). The Pied Wheatear.
According to Briggs a regular winter visitor to the Valley, keeping mainly to barren country : earliest and latest dates seen are September 8 and March 8. It breeds in the Khaibar Pass, where Briggs on several occasions saw it carrying nesting material, but never had the opportunity of examining a nest.

22. **Œnanthe capistrata** (Gould). The White-headed Wheatear.
♂ November 15, 1925, ♂ December 6, 1925. According to Briggs, breeds in all the hills round the Peshawar Valley down to about 2,000 ft. A pair were watched at work on a nest in the Manki Pass, a few miles S. of Nowshera, on March 21, 1923. The nest was then almost complete. It is much commoner as a winter visitor to the Peshawar Valley than the last species. Briggs notes that ' Individuals of this species seem to be much attached to limited localities in their winter area. For example, on the road between Nowshera and Risalpur I could be certain of seeing four birds of this species any day in the cold weather. Near a lime kiln there was always a pair of them, male and female, and within fifty yards of a certain tree there was always a single male. There was always another single male in the compound of the house at Risalpur where I usually stayed. I always looked for him on the telegraph wires outside the house on my arrival, and nearly always saw him there.' Briggs' earliest date for the species is September 18. He, like other observers in other areas, remarks on the preponderance of males in winter both in *Œ. picata* and *Œ. capistrata.*

23. **Œnanthe opistholeuca** (Strickland). Strickland's Wheatear.
♂ December 21, 1925, ♂ December 11, 1925. Not recorded by Briggs, but said by Osmaston to occur in the dry country in winter, though not so commonly as the last species.

24. **Œnanthe isabellina** (Cretsz). The Isabelline Wheatear.
♀ November 15, 1925, Peshawar. ♂ January 25, 1926, Risalpur. Fairly common locally in winter, generally in the neighbourhood of cultivation, in the dry, desert land at the foot of the hills.

25. **Œnanthe xanthoprymna chrysopygia** (De Filippi). The Red-tailed Wheatear.
♀♀ December 17, 1925, Bara Fort, five miles south-west of Peshawar. Fairly common in the Khaibar, and probably breeds there. In the winter it is not rare in the dry, desert country below the foothills.

It is noteworthy that neither Osmaston nor Briggs record the desert Wheater, *Œ. deserti*, which is so common a winter visitor to the Punjab.

26. **Phœnicurus erythronotus** (Evesrm.) Eversman's Redstart.
♂ January 22, 1926, Dilazak, ♀ December 7, 1925, ♀ December 10, 1925, Peshawar. Stated by Osmaston to be seen occasionally throughout the winter in the irrigated area.

27. **Phœnicurus ochrurus phœnicuroides** (Moore). The Kashmir Redstart.
A common winter visitor, but for some reason less numerous than usual in the winters of 1924–25 and 1925–26. Earliest date seen September 24, latest date April 17. It occurs both in the wet and dry areas, but, according to Briggs, shows a strong preference for the neighbourhood of Tamarisk trees.

28. **Chaimarrhornis leucocephala** (Vigors). The White-capped Redstart.
One was seen by Briggs in the Khaibar Pass on December 12, 1924.

29. **Rhyacornis fulginosa** (Vigors). The Plumbeous Redstart.
Recorded by Briggs as fairly common on the Khaibar Stream during the cold weather.

30. **Cyanosylvia suecica pallidogularis** (Sarudny). The Eastern Red-spotted Bluethroat.
♂ October 31, 1925, ♂ November 18, 1925, ♂♂ November 28, 1925, ♂ December 6, 1925, Peshawar. ♂ January 22, 1926, ♀ December 29, 1925, Pabbi. Very numerous on passage, passing through the valley between April 10 and May 10, in spring, and between September 14 and October 14 in autumn. During the spring migration they seem to pass through almost entirely in pairs, and may frequently be seen courting. In autumn they are less numerous, and seem as a rule to make a shorter stay. In the winter they are not uncommon in the irrigated country in dense cover such as sugar-cane, and grass and bulrushes especially near swamps.

31. **Saxicoloides fulicata cambaiensis** (Lath.). The Indian Robin.
♂ November 15, 1925, Peshawar. A resident, but more numerous in summer than in winter. In this area (as at Kohat), it avoids the neighbourhood of houses, and prefers barren country, especially the stony Mahomedan graveyards. Eggs found by Briggs between April 18 and May 24.

32. **Turdus atrogularis** (Temm.). The Black-throated Thrush.
♂ November 10, 1925, ♂ December 3, 1925, ♂♀ December 8, 1925, Peshawar. A very common winter visitor, found chiefly in and around the station area and in orchards. It is most numerous in February, and the latest date on which it is recorded is March 28.

33. **Turdus viscivorus** (L). The Missel Thrush.
One was seen by Briggs at Peshawar on February 2, 1921.

34. **Oreocincla dauma** (Lath.). The Small-billed Mountain Thrush.
One was noted by Briggs on February 9, 1924.

35. **Monticola solitaria pandoo** (Sykes). The Blue Rock Thrush.
Not found in Peshawar according to Osmaston, but observed in the neighbouring rocky hills, Khaibar, etc.

36. **Myiophoneus temminckii** (Vigors). The Himalayan Whistling Thrush.
Not found in Peshawar according to Osmaston, but seen on the streams in the neighbouring foothills.

37. **Prunella atrogularis** (Brandt). The Black-throated Accentor.
♂ January 1, 1926, Peshawar. Not uncommon, according to Osmaston, in January and February in Pirbala and other woods.

38. **Musicapa striata neumanni** (Poche). The Spotted Flycatcher.
Briggs records that he saw a flock of these Flycatchers (and was certain that they were not *Alseonax latirostris*) feeding in his compound at Peshawar on April 19, 1921, and again from October 6 to 16, 1921, and on April 4, 1922.

39. **Musicapa hypoleuca** (Pallas). The Pied Flycatcher.
Briggs writes :—'A few birds indistinguishable from the British species pass through Peshawar almost every spring. Earliest and latest dates seen February 18 and March 30. The only year that I have seen the species in the autumn was 1925, when a pair fed in my compound almost every day from October 31, till I left Peshawar on January 11.' The species has not yet been included in the Indian list, so future observers at Peshawar should make every effort to verify this occurrence by obtaining specimens. The species does not appear to have been recorded nearer than Tehran.[1]

40. **Siphia parva parva** (Bechst.). The Red-breasted Flycatcher.
♂ October 29, 1925, ♂ November 8, 1925, ♀ December 1, 1925, Peshawar. Chiefly a passage migrant, the majority passing through in spring between March 24 and April 21. First noted on the autumn migration on October 21. After the first rush their numbers gradually decrease until only a few remain for the

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[1] *J.B.N.H.S.*, vol. xxvii, p. 114.

winter. They are found in the orchards and station area, and along all roads bordered with Tamarisks. Red-breasted males are very rare amongst the winter birds.

41. **Culicicapa ceylonensis.** The Grey-headed Flycatcher.
♀ November 7, 1925, Peshawar. The above specimen was obtained by Osmaston.

42. **Terpsiphone paradisi** (L). The Paradise Flycatcher.
A few breed in the valley, as Briggs found a female feeding three young in the trees overhanging the Grand Trunk Road, eight miles east of Peshawar on June 20, 1923. It is, however, a passage migrant in spring and autumn. Briggs states that they pass through in large numbers, but appear to stop only one day. That day falls, as far as his observations go, between April 23 and 29, in the spring, and between September 19 and 29, in the autumn. The race has not been identified.

43. **Lanius excubitor lahtora** (Sykes). The Indian Grey Shrike.
o ? January 13, 1926. Not common, but appears to be resident. It is confined to barren stretches of country near the foot of the hills, showing a preference for ground studded with stunted Ber trees.

44. **Lanius vittatus** (Valenc.). The Bay-backed Shrike.
A summer visitor, very common in cultivated ground. Earliest date seen March 23, latest date September 19. It has two broods, building a fresh nest for each. Eggs found between April 7 and July 7. Stragglers were seen by Briggs near Taru Jabba on February 20, 1923 and January 25, 1924.

45. **Lanius schach erythronotus** (Vigors). The Rufous-backed Shrike.
♂ November 13, 1925, Peshawar. Resident, but much more common in summer than in winter and a bird of the irrigated tract. A male of this species was observed by Briggs to feed in his garden almost daily for the whole of the six years he was in Peshawar. For the greater part of the year this bird was alone, but, in the spring he was joined by a female, generally about the middle of March. Each year they built either in his garden or the one next to it, and usually succeeded in bringing off two broods of young. Once or twice they used the same nest for both broods. The young of the first brood always disappeared before the second brood had left the nest, and as soon as the second brood was able to fly at all strongly, generally some time in August, they and the hen disappeared. It is, of course, unsafe to generalize from a single case of this sort, but it might be worth while to shoot a few Rufous-backed Shrikes in winter with a view to discovering whether the decrease in their numbers each winter is due to the migration of the females. It is to be noted that the one specimen obtained by Osmaston, in November, was a male.

Osmaston remarks that the bird is a wonderful mimic ; he heard it giving in quick succession an accurate imitation of the notes of the following :—House Sparrow, Swallow, Indian Swift, Parrakeet, Mynah, Sandpiper, Bulbul and Common Babbler. Eggs found between April 10 and July 1.

46. **Lanius cristatus isabellinus** (Hemp. and Ehr.). The Isabelline Shrike.
♂ November 30, 1925, ♂ January 26, 1926, Peshawar. The above two examples, procured by Osmaston, are the only records.

47. **Tephrodornis pondiceriana** (Gmel.). The Common Woodshrike.
One was seen by Briggs on the outskirts of Peshawar on March 7, 1921.

48. **Pericrocotus brevirostris brevirostris** (Vigors). The Short-billed Minivet.
♀ November 10, 1925, ♂ December 1, 1925, Peshawar. An erratic winter visitor, appearing for a day or two at a time in small flocks, never more than ten strong.

49. **Dicrurus macrocercus** (Vieill.). The King Crow.
A common summer visitor, laying in the first half of May. Earliest date seen March 22, latest date October 1.

50. **Dicrurus leucocephalus longicaudatus** (A. Hay). The Ashy Drongo.
A pair was seen by Briggs in the Khaibar, May 28, 1925.

51. **Acrocephalus stentoreus brunnescens** (Jerdon). The Indian Great Reed Warbler.
♂ November 5, 1925. The above specimen shot by Osmaston was alone in a swamp. He did not meet the species again till March 15, when he saw and heard others, doubtless on migration.

52. **Lusciniola melanopogon mimica** (Madrasz). The Moustached Sedge Warbler.
♂ November 5, 1925, o ? January 22, 1926, Peshawar, ♀ December 29, 1925, Pabbi. Obtained by Osmaston, who found it common and noisy, though difficult to observe in the swamps, especially in borrow-pits by the railway.

53. **Cisticola juncidis cursitans** (Frankl.). The Fantail Warbler.
♂ November 12, 1925, ♀ December 4, 1925, Peshawar. Found by Osmaston in some of the grassy swamps, but stated to be not very common.

54. **Franklinia buchanani** (Blyth). The Rufous-fronted Wren Warbler.
♀ November 15, 1925, Peshawar. The above specimen obtained by Osmaston in the dry country supplies the only record.

55. **Sylvia curruca affinis** (Blyth). The Indian Lesser Whitethroat.
♂ November 5, 1925, ♀ November 6, 1925, ♂ December 11, 1925, Peshawar. A fairly common winter visitor.

56. **Sylvia curruca minula** (Hume). The Small Whitethroat.
♂ December 11, 1925, Peshawar. The above specimen was obtained by Osmaston.
Briggs reports that individuals of one or other of the above races of *S. curruca* spend the summer in the Tamarisk scrub on the banks of the Kalapani River. Presumably they are non-breeders.

57. **Phylloscopus collybita tristis** (Blyth). The Siberian Chiff-chaff.
♂ October 29, 1925, ♀ November 3, 1925, ♂ November 8, 1925, ♀ December 11, 1925, Peshawar. A very common winter visitor, especially in the wet country. It is to be found in every clump of trees, also in road-avenues of Shisham and Tamarisk, and often feeding by streams. The song may be heard in April before the birds leave for their summer quarters.

58. **Phylloscopus subviridis** (Brooks). Brooks' Willow Warbler.
♂ November 11, 1925, Peshawar. A winter visitor, and probably not uncommon.

59. **Scotocerca inquieta striata** (Brooks). The Streaked Scrub Warbler.
A resident and fairly numerous on the dry, rocky hill sides on the spur which separates Kohat from Peshawar, also on dry ground in the vicinity of Risalpur. Osmaston found a nest with six eggs in the former place on March 12, 1926, and Briggs found a nest containing one young bird on the point of leaving the nest near Risalpur on April 15, 1925.

60. **Horornis pallidus** (Brooks). The Pale Bush Warbler.
Observed by Osmaston towards the end of February in the Pirbala woods, its note being quite unmistakeable.

61. **Cettia cetti cettioides** (Hume). The Eastern Cetti's Warbler.
♂ October 31, 1925, ♂ November 23, 1925, ♂ January 9, 1926, ♂ January 12, 1926, ♂ January 25, 1926, ♂ January 26, 1926, Peshawar. Fairly common, and widely distributed in every swampy patch, provided there is ample cover of bulrushes, reeds, or long grass. They are rarely seen, being extremely shy and careful not to expose themselves. Their presence is, however, revealed by a rather loud 'click' repeated at intervals from dense cover. The above series was only obtained by the exercise of much patience and preseverance

62. **Prinia gracilis lepida** (Blyth). The Streaked Wren Warbler.
♀ November 26, 1925, ♂♀ November 30, 1925, Peshawar, ♂ January 28, 1926, Risalpur. Generally distributed in and around grassy swamps as well as in cultivated fields.

63. **Prinia inornata inornata** (Sykes). The Indian Wren Warbler.
♀ November 5, 1925, ♀ November 10, 1925, ♀ November 11, 1925, ♂♀ November 16, 1925, ♂ November 26, 1925, ♂ December 26, 1925. A common bird in long grass in moist localities, occurring in the winter in small parties.

64. **Oriolus oriolus kundoo** (Sykes). The Indian Oriole.
Status uncertain. Briggs says :—' Common in April and May. A few pairs may breed in the valley. One young bird seen on the outskirt of Peshawar, August 31, 1921.'

65. **Pastor roseus** (L). The Rosy Starling.
♂ November 7, 1925, Peshawar. ' Passes through in large flocks in the late summer and early autumn. The earliest flocks to arrive are composed almost entirely of adult males. In the later flocks young birds and females predominate. They appear to feed mainly on the fruits of various species of *Ficus*. In spring they appear either to go to their breeding area by another route, or to pass through the valley without halting. I have only seen them in the spring twice ; on April 13, 1924, when a small flock left a group of trees at dawn and flew steadily westward ; and in April 1925, when large flocks passed through between the 21st and 25th of the month. Earliest date seen on the southward migration July 14 ; latest date October 21.'—(Briggs). In 1925, however, Osmaston saw small flocks early in November.

66. **Sturnus vulgaris porphyronotus** (Sharpe). The Central Asian Starling.
♂ November 18, 1925, ♂ November 21, 1925, ♂ December 2, 1925. Peshawar.

67. **Sturnus vulgaris poltaratzskyi** (Finsch). Finsch's Starling.
♂ November 7, 1925, ♀ November 21, 1925, ♂ November 24, 1925, ♂ December 2, 1925, Peshawar.

68. **Sturnus vulgaris humii** (Brooks). Hume's Starling.
Under the heading *Sturnus humii* the following appears in *Nests and Eggs of Indian Birds*, Hume and Oates, vol. i, p. 369 :—This Starling lays towards the end of April at Peshawar, where I found it nesting in willow-trees in the Cantonment compounds. (See also *Ibis*, 1870, p. 529.)

Both *S. v. porphyronotus* and *S. v. poltaratzskyi* are numerous as winter visitors, and they flock together. The earliest date on which Briggs saw Starlings was October 12, and the latest date April 13, but most years all have left before the end of March. Neither Osmaston nor Briggs identified *S. v. humii*, and the latter found no Starlings breeding in the valley, though after reading the above quotation from Hume he looked for them for six successive seasons.

69. **Acridotheres tristis tristis** (L). The Common Mynah.
Exceedingly common and a resident. Eggs were found from the middle of April to the end of August, there being at least two broods.

70. **Acridotheres ginginianus** (Latham). The Bank Mynah.
♀ November 7, 1925, Peshawar. A summer visitor. Breeds in very large colonies in the sand-cliffs near Risalpur. Fresh eggs found in great numbers on May 9, 1922, and May 15, 1923. In the autumn mixes in small flocks with *A. tristis* before departing. Earliest date seen March 22, latest date October 12 (Briggs). Osmaston, however, saw small parties about on his first arrival in 1925, but not after the middle of November.

71. **Uroloncha malabarica** (L). The White-throated Munia.
♀ November 6, 1925, Peshawar. A resident, but not very numerous. Rarely seen near houses.

72. **Amandava amandava** (L). The Red Avadavat.
♂♀ November 14, 1925, Peshawar. ' Not common, but small parties seen on grasslands on two or thee occasions.' (Osmaston). Many are sold in the bazaars at Peshawar, and Briggs remarks on the ease with which they escape from their cages.

73. **Caropdacus erythrinus** (Pall). The Common Rosefinch.
' Pass through Peshawar in flocks, staying for a few days in spring. I have never seen them on their autumn journey. They seem to time their arrival at Peshawar to coincide with the ripening of the mulberries, on which they feed. Their numbers vary greatly from year to year. In 1924 the mulberry crop was

good, and the Rosefinches numerous; in 1925 the mulberry crop was poor, and Rosefinches far less numerous. Earliest date seen April 18, latest date April 30. (Briggs).

74. **Metaponia pusilla** (Pall.). The Gold-fronted Serin.
♂ November 25, 1925, Peshawar. The above young bird, secured by Osmaston, was a solitary straggler.

75. **Hypacanthis spinoides.** (Vigors). The Himalayan Greenfinch.
♀ November 25, 1925. Osmaston secured the above specimen from a small flock, the only lot seen.

76. **Gymnorhis xanthocollis** (Burton). The Yellow-throated Sparrow.
A common summer visitor, first observed on April 10. Numerous nests found between May 16 and 23, all in holes in Tamarisk trees.

77. **Passer domesticus** (L). The House Sparrow.
♀ December 6, 1925, ♂ ♀ December 13, 1925, ♂ ♂ ♂ ♀ ♀ January 4, 1926, Peshawar. A very numerous resident, breeding from the middle of March to the end of september or beginning of October. Although commonly building in houses, it frequently builds in trees in the Peshawar Valley, a trait shared by the sparrows of the Quetta Valley, but not usual in the plains of India. Ber trees are preferred. In winter large flocks are found far out from the station in the irrigated land.

78. **Passer hispaniolensis** (Tschusi). Tschusi's Sparrow.
Recorded by Hume (*Ibis.*, 1870) as being in breeding condition in the Peshawar Valley in April. It was not observed by Osmaston or Briggs.

79. **Emberiza leucocephala** (Gmelin). The Pine Bunting.
♂ November 29, 1925, ♂ ♂ December 30, 1925, ♂ ♂ January 4, 1925, Peshawar. A fairly common winter visitor, in November December, and January, occurring in rather large flocks both in swampy ground and in fields in the cultivated tract.

80. **Emberiza schœniclus pallidior** (Hartert). The Reed Bunting.
♂ January 9, 1926, ♂ February 8, 1926, Peshawar. Found by Osmaston to be locally common in winter occurring in small flocks in the wet country.

81. **Emberiza cia par** (Hartert). The Meadow Bunting.
♀ November 14, 1925, ♂ November 15, 1925. A fairly common winter visitor both to the irrigated tract and to the uncultivated country, especially up the Khaibar and at Attock.

82. **Emberiza melanocephala** (Scop.) The Black-headed Bunting.
Briggs notes that a small flock fed daily in the barley fields outside Peshawar from May 7 to May 20, 1920.

83. **Emberiza icterica** (Eversm). The Red-headed Bunting.
Passes through in large numbers in the spring, earliest and latest dates April 23, and May 10. Not seen in the autumn, except for a single bird on the outskirts of Peshawar Cantonment on August 13, 1923.

84. **Riparia riparia indica** (Ticehurst and Whistler). The Small Sand-Martin.
o? December 9, 1925, o? January 1, 1926, Peshawar. Omaston found this form common along the Kabul River and its branches and canals in December, when it was 'singing'. Briggs says that it is a resident and numerous, but subject to local movement within the Valley in relation to the supply of insects. Eggs found February 14 to March 4. They breed in suitable spots in the banks of the Kabul River, and in large colonies in the same sand cliffs near Risalpur which are later occupied by Bank Mynahs. He believes that the Bank Mynhas enlarge and use the hole of the Sand Martins frequently.

85. **Ptyonoprogne rupestris** (Scop.). The Crag Martin.
A few were seen by Osmaston in November, 1925.

86. **Hirundo rustica rustica** (L). The Swallow.
♂ ♂ ♂ ♀ ♀ December 6, 1925. Peshawar. Osmaston states that he found it common throughout the winter months. The above five specimens were secured at a single shot as they sat on a telegraph wire. Briggs says :—Pass through in large flocks in spring and autumn, the autumn flocks frequently

arriving after rain on the hills to the north west. Some are to be seen throughout the year. Those which remain through the summer are probably non-breeders, as I have never seen or heard of a nest, though I once saw one picking up mud from the side of a pool as though to build. It is also possible, however, that some, if not all, of those seen in the summer breed in the hills, and come down to the valley during the day for food. In summer they always appear to be more numerous after rain.

87. **Hirundo smithii filifera** (Stephens). The Wire-tailed Swallow.
A fairly numerous summer visitor; earliest date seen April 21. Eggs found from May 1, onward, and young seen in the nest as late as September 27. This species sometimes uses the same nest for more than one season, if it is not destroyed by floods. Briggs notes that every nest of this species that he examined was in a position where it was liable to be flooded out, in low culverts. In the summer of 1925, when an unusual number of heavy thunderstorms visited the Peshawar Valley no nest escaped destruction before the young were ready to fly with the exception of one found containing young on September 27.

88. **Hirundo daurica** (L). The Striated Swallow.
A small flock of Striated Swallows (subsp. ?) was seen by Briggs hawking for insects over the Mall at Nowshera on April 13, 1923.

89. **Motacilla alba dukhunensis** (Sykes). The Indian White Wagtail.
o ? November 10, 1925, ♂ November 11, 1925, ♂ ♀ December 15, 1925, Peshawar. A very common winter visitor found in the irrigated area. Earliest date seen September 10, latest date May 4.

90. **Motacilla alba personata** (Gould). The Masked Wagtail.
A fairly numerous winter visitor. Earliest date seen August 21, latest date May 11.

91. **Motacilla cinerea caspica.** (Gmelin). The Grey Wagtail.
A fairly numerous winter visitor. Earliest date seen September 22, latest date May 9.

92. **Motacilla flava thunbergi** (Billberg). The Grey-headed Wagtail.
Large flocks pass through in the spring and autumn, and a few stay for the winter. Earliest date seen September 6, latest date May 13. In the autumn all the flocks appear to be composed of both young and old.

93. **Motacilla citreola calcarata.** Hodgson's Yellow-headed Wagtail.
♂ Dec. 21, 1925 ♀ Dec. 21, 1925.
Occasionally seen throughout the winter; most numerous in March and April. A few, probably non-breeders, stay all the year round by the Kalapani River.

94. **Anthus richardi rufulus** (Vieill.). The Indian Pipit.
o ? November 27, 1925, Peshawar. Not very common, but occasionally seen in grasslands near cultivation. Briggs found a nest with two partially incubated eggs on April 12, 1921.

95. **Anthus campestris** (L). The Tawny Pipit.
♂ December 11, 1925, Peshawar. Osmaston says that it is not common, but that he saw it occasionally near the meeting place of the wet and the dry country.

96. **Anthus spinoletta blakistoni** (Swinhoe). The Water Pipit.
♂ November 2, 1925, ♂ November 11, 1925, o ? November 14, 1925, ♂ ♀ December 15, 1925, ♂ December 31, 1925, Peshawar. An exceedingly common winter visitor, found about swamps, and in moist irrigated fields.

97. **Alauda gulgula** (Frankl.). The Smaller Skylark.
Apparently breeds in the district as on April 16. Briggs found a clutch of five partly incubated eggs at Pajaggi which he attributes to this species.

98. **Alauda arvensis dulcivox** (Brooks). The Eastern Skylark.
♂ December 12, 1925, Peshawar. A common winter visitor, found in flocks in the fields.

99. Calandrella raytal adamsi (Hume). The Indus Sand Lark.
♂♂ ♀ December 21, 1925. Pabbi; February 25, 1926. Peshawar. Found by Osmaston in flocks in December, feeding near swampy ground.

100. Calandrella rufescens persica (Sharpe). Sharpe's Short-toed Lark.
♂ January 28, 1926, Risalpur. The above specimen was obtained by Osmastan from a small flock which was very wild.

101. Galerida cristata chendoola (Frankl.). Franklin's Crested-Lark.
♂ November 3, 1925, ♂ ♀ December 3, 1925, Peshawar. Osmaston says that it is widely distributed though not common. Briggs says that it is resident and numerous, but that a great number appear to move to the higher ground surrounding the valley after bringing off their young. Eggs found throughout April.

102. Galerida cristata magna (Hume). Hume's Crested Lark.
Briggs says:—' A winter visitor, most numerous in spring and autumn when on passage.'

103. Ammomanes deserti phœnicuroides (Blyth). The Desert Finch-Lark.
A resident, and fairly numerous on barren ground. Eggs found between May 29 and July 4.

104. Zosterops palebrosa occidentalis (Ticehurst). The White-eye.
♀ November 8, 1925. Fairly common in the wooded areas in winter. Briggs remarks that it appears spasmodically in large flocks, especially after rain.

105. Cinnyris asiatica (Latham). The Purple Sunbird.
A common summer visitor. Earliest date seen March 17 (apart from a straggler, a male in breeding plumage, seen by Briggs in the Khaibar on February 22, 1921). Latest date seen September 11. Briggs found fresh eggs from April 29 to June 1, and heard of earlier and later occurrences. He notes that this species, if undisturbed, appears to use the same nest for a second brood.

106. Picus squamatus (Vigors). The Scaly-bellied Green Woodpecker.
Seen on two occasions by Osmaston in Pirbala wood in January 1926.

107. Dryobates scindianus (Horsf. and Moore). The Sind Pied Woodpecker.
♂ November 25, 1925, ♂ ♀ December 26, 1925, Peshawar. A common resident in all wooded areas in the irrigated tract. The nest-holes are commenced in March.

108. Liopicus mahrattensis aurocristatus (Tickell). The Mahratta Woodpecker.
♂ January 1, 1926, Peshawar. A common resident, found in the same area as the last species.

109. Iynx torquilla (L). The Wryneck.
♂ November 13, 1925, ♀ November 29, 1925, ♀ January 7, 1926, ♀ January 22, 1926, Peshawar. A fairly common winter visitor, and rather more numerous on passage according to Briggs.

110. Coracias benghalensis benghalensis (L). The Blue Jay.
A resident in small numbers; its numbers are greatly augmented in summer by an immigration about March. Eggs found between April 21 and May 25. On May 15, 1923, Briggs found a Roller sitting on four of its own eggs and one Bank Mynah's egg, in a colony of the latter species.

111. Coracias garrula semenowi (Loud. and Tsc). The Kashmir Roller.
Passes through in large numbers in spring and autumn. A few stay to breed usually keeping well away from towns and villages. Eggs found May 10, 1923, and May 15, 1923.

112. Merops orientalis (Latham). The Bee-Eater.
A very numerous summer visitor, first observed by Osmaston on March 10. Briggs gives his earliest date as March 8, and latest date October 11. Eggs are laid at the end of April or beginning of May.

113. Merops superciliosus javanicus (Horsf). The Blue-tailed Bee-eater.
A summer visitor, less numerous than the last species. It avoids the neighbourhood of houses. Earliest date seen April 2, latest date September 6.

114. Merops persicus persicus (Pall). The Blue-cheeked Bee-eater.
Briggs says :—' Only once seen, and then in large numbers, of which a considerable proportion were young birds : September 6, 1925.'

115. Ceryle rudis leucomelanura (Reich). The Pied Kingfisher.
♀ December 17, 1925. A resident species, common on the Kabul River and its branches. Breeding commences in March, and Briggs found eggs on April 1, 1924.

116. Alcedo atthis. The Common Kingfisher.
♂ November 20, 1925. Fairly common along streams and canals, and apparently resident.

117. Halcyon smyrnensis smyrnensis (L). The White-breasted Kingfisher.
♂ November 8, 1925. A resident, and common throughout the irrigated country and near swamps. Lays at the end of April and the beginning of May.

118. Upupa epops epops. The European Hoopoe.
♀ December 28, 1925, Peshawar. Briggs states :—' Resident and common, but the individuals which spend the winter in and about Peshawar do not seem to be the same as those which breed, as in the autumn and spring there is a period of a few days in which in some years there appear to be no Hoopoes at all, while in other years they appear to be far more numerous than at normal times. The explanation of this would seem to be that the Hoopoes which winter in Peshawar go further north or east to breed, and that their place is taken by birds of the same subspecies from the south. Sometimes those from the south arrive before, and sometimes after the departure of the others. Eggs are laid in the second half of April. Osmaston remarks that Hoopoes were not common throughout the winter, but that they became more numerous in February and March, and that breeding commences in late March. These notes both suggest the marked spring passage which one would expect in the Peshawar Valley.

119. Micropus affinis (Gray). The Common Indian Swift.
Numerous and resident. It breeds chiefly in April, May and September, but occasionally in almost every month.

120. Caprimulgus sp. The Night jar.
Briggs notes that some species is not uncommon in the summer, and that he picked up a fledgling in May 1923.

121. Cuculus canorus (L). The Cuckoo.
One was seen by Briggs on April 23, 1921.

122. Eudynamis scolopaceus scolopaceus. (L). The Koel.
A summer visitor less common in the Peshawar District than further down country. Earliest date heard May 12. Not heard after the end of August.

123. Palæornis nipalensis eupatria (Hodg.). The Large Indian Parrakeet.
Common and resident. Osmaston obtained fresh eggs on March 2, from a hole in a mosque in Peshawar City.

124. Palæornis torquatus (Bodd.). The Rose-ringed Parrakeet.
Resident and numerous.

125. Asio flammeus (Pont.). The Short-eared Owl.
November 17, 1925, Peshawar. Not uncommon throughout the winter in grasslands.

126. Strix aluco biddulphi. The Wood-Owl.
A single bird was seen and shot by Osmaston on November 18, 1925.

127. Bubo bubo bengalensis (Frankl.). The Indian Great Horned Owl.
December 2, 1925, resident. Briggs found two young, not quite able to fly, near the Kalapani River on May 17, 1922. At the same place on another occasion he watched an adult bird of the species being mobbed by two Kashmir Rollers. The Owl was sitting in full sunlight at about 10.0 a.m. on a boulder on top of the cliff above the river, and the two Rollers kept swooping at its head. For about a quarter of an hour it took no notice of these demonstrations

beyond bowing its head slightly as the Rollers came near, after which it flew away. Osmaston notes that it is fairly common wherever there are woods of any extent.

128. **Carine brama** The Spotted Owlet.
January 6, 1926. The Peshawar Resident. Common around Peshawar wherever there are trees. Eggs found April 1 to 14.

129. **Pandion haliaëtus** (L). The Osprey.
Seen on the Kabul River by Osmaston.

130. **Gyps fulvus** (Habl.) The Griffon Vulture.
Said by Osmaston to be common near Peshawar, but the exact form requires verification.

131. **Pseudogyps bengalensis** (Gmel.). The White-backed Vulture.
Appears spasmodically at all seasons though it is not known to breed in the Valley.

132. **Neophron percnopterus** (L). The Neophron Vulture.
Fairly common and resident.

133. **Gypaëtus barbatus.** The Lammergeyer.
Rarely seen near Peshawar. Common in the neighbouring hills and in the Khaibar Pass.

134. **Aquila heliaca** (Savigny). The Imperial Eagle.
One was seen by Osmaston and Briggs on December 21, 1925, near the Pabbi Swamp.

135. **Aquila nepalensis** (Hodgs.) The Steppe Eagle.
Not uncommon near Peshawar Cantonments in winter. (Osmaston).

136. **Aquila rapax vindhiana** (Frankl.) The Indian Tawny Eagle.
A resident and fairly common.

137. **Butastur teesa** (Frankl.). The White-eyed Buzzard.
One was seen by Osmaston in March 1926.

138. **Cuncuma leucorypha** (Pallas). Pallas' Fishing Eagle.
One was noted by Osmaston in January 1926 feeding on a dead animal by the Kabul River.

139. **Haliastur indus** (Bodd). The Brahminy Kite.
Occasionally seen, most frequently after rain towards the end of the summer. (Briggs).

140. **Milvus migrans govinda** (Sykes). The Pariah Kite.
Very common and resident. Eggs nearly all laid in the first week of March. This species has a curious habit of picking up sticks as if to commence building operations about the middle of September, and continues to do this till the weather turns colder in October, when it seems to do no more till nest-building begins in earnest towards the end of January or beginning of February.

141. **Circus æruginosus** (L). The Marsh Harrier.
Common near extensive swamps in winter.

142. **Circus macrurus** (S. G. Gmel.). The Pale Harrier.
Seen occasionally in winter. (Osmaston).

143. **Circus cyaneus** (L). The Hen Harrier.
Seen occasionally in winter. (Osmaston).

144. **Buteo ferox** (S. G. Gmel.). The Long-legged Buzzard.
♂ December 21, 1925, Pabbi. ♀ December 30, 1925, Peshawar. A common winter visitor to the irrigated country. In the dry foothills it may be resident in small numbers, as Cock records having taken the eggs of this species about three miles from Nowshera in 1872. (*Nests and Eggs*, vol. iii, p. 126).

145. **Accipiter nisus nisosimilis.** The Sparrow Hawk.
♂ November 23, 1925, Peshawar. A fairly common winter visitor.

146. **Falco jugger** (Gray). The Lugger Falcon.
Said by Briggs to be resident, but apparently commoner in March and April than at other times of the year.

147. **Falco chiquera chiquera** (Daudin). The Red-headed Merlin.
♂ December 22, 1925, Peshawar. A fairly common resident, generally seen in pairs. Eggs taken at Risalpur, March 2, 1925.

148. **Falco tinnunculus** (L). The Kestrel.
A bird in juvenile plumage was shot by Osmaston on December 21, 1925, near Pabbi. The species is fairly common in the valley in winter, keeping mainly to desert and swampy country.

149. **Columba livia** subsp? The Blue Rock Pigeon.
Fairly numerous at Attock, on the cliffs by the Kalapani River, and on rocks near Warsak.

150. **Palumbus palumbus casiotis** (Bonap.). The Eastern Wood Pigeon.
A few were seen by Osmaston in a large orchard on February 23, 1926.

151. **Streptopelia senegalensis cambaiensis** (Gmel.). The Little Brown Dove.
A resident, but more numerous in summer than in winter. Breeds throughout the hot weather.

152. **Streptopelia decaocto decaocto** (Frival). The Indian Ring-Dove.
A very common resident in the irrigated tract. Breeds from the beginning of April to the end of the hot weather.

153. **Œnopopelia tranquebarica tranquebarica** (Herm.). The Red Turtle Dove.
A regular but not very numerous summer visitor. Earliest date seen March 14.

154. **Pterocles indicus** (Gmel.) The Painted Sandgrouse.
This species is apparently resident in small numbers at Rustom, some twenty miles from Mardan, in the Buner foothills. As it has also been procured in the Orakzai, about half way batween Bannu and Peshawar, and Mr. Donald procured it west of Shinwari, it is probably more generally distributed in the foothills than is generally known.[1]

155. **Pterocles coronatus atratus** (Hartert). The Coronetted Sandgrouse.
This species is said to occur near Jamrud.[2]

156. **Pteroclurus alchatus caudacutus** (S. G. Gmel.). The Large Pintail Sandgrouse.
A few pairs are said to breed in the vicinity of Mardan in June.[3]

157. **Pteroclurus senegalensis** (Licht.). The Common Sandgrouse.
Capt. Cock's notes on the breeding of the Common Sandgrouse will be found in Hume's *Nests and Eggs*, second edition, vol iii, p. 362.
A few are shot between Nowshera and Attock every year.

158. **Coturnix coturnix coturnix** (L). The Common Quail.
Passes through in large numbers in April and September. A few stay on in the autumn until well into December, and may, perhaps, if they escape being netted, spend the whole winter in the valley.

159. **Coturnix coromandelica** (Gmel.) The Rain-Quail.
Said by Osmaston to be common in the fields in November.

160. **Ammoperdix griseogularis griseogularis** (Brandt). The See-see.
Resident in the low hills surrounding the valley. It may sometimes be found on the outcrops of limestone which rise in the middle of the valley.

161. **Ortygornis pondicerianus** (Gmel.). The Grey Partridge.
Fairly numerous in the low hills surrounding the valley.

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[1] Stuart Baker, *Game Birds of India*, vol. ii, p. 256. [2] loc. cit., p. 268.
[3] loc. cit., p. 283.

162. **Rallus aquaticus korejewi** (Sarudny). The Turkestan Water-Rail.
♀ November 24, 1925, ♂ January 26, 1926, Peshawar. Common in almost every swamp throughout the winter months. Very shy, and flushed with great difficulty. The call, heard at dawn and after sunset, is peculiar, somewhat resembling the noise made by a small pig in trouble. (Osmaston).

163. **Fulica atra** (L). The Coot.
Briggs says that it is very numerous in all suitable localities at all seasons, but repeated search failed to discover a nest. Osmaston, on the other hand, considers it not common.

164. **Gallinula chloropus** (L). The Water-hen.
Fairly common in winter according to Osmaston.

165. **Otis tarda** (L). The Great Bustard.
Of the six examples of the Great Bustard which have been obtained in India four can be claimed by the Peshawar District.

The first specimen, a female, was obtained on December 23, 1873, at Hastnagur near Mardan and just north of the Kabul River; a party were found in some fields of mustard and giant millet, and they were so shy that, though they remained in the neighbourhood for some weeks, no other specimen could be obtained. (Hume, *Ibis*, 1871, p. 404.)

Two other females were shot in the same locality on January 6, or 8, 1911. There were about twenty-five of them, and they were observed from roughly December 20, 1910, to the beginning of February. (*Field*, February 11, 1911.)

Finally Sir George Roos-Keppel recorded, in a letter dated December 1, 1917, to the B.N.H.S. (Journal, vol. xxv, p. 745) that one had just been brought in to him from the neighbourhood of Peshawar.

166. **Chlamydotis undulata macqueeni** (Gray and Hardw). The Houbara.
An account of Houbara hawking on the Jamrud Plain will be found in *Game Birds of India*, vol. ii, p. 195. (Stuart-Baker.) They are commonly hawked about Mardan by officers of the Guides.

167. **Lobivanellus indicus** (Bodd.). The Red-wattled Lapwing.
A common summer visitor, first observed by Osmaston on February 24, 1926. Briggs observed it occasionally in the winter.

168. **Vanellus vanellus** (L). The Peewit.
♂ December 19, 1925, Peshawar. Common in flocks in winter on open and wet land. Osmaston first observed on November 12, but found it most abundant in December and January.

169. **Charadrius dubius** (Scop.). The Little Ring-Plover.
Common on sandbanks of the Kabul River and on the margins of swampy pools in winter.

170. **Tringa hypoleuca** (L). The Common Sandpiper.
A fairly common winter visitor to the banks of sluggish streams or near pools and marshy ground.

171. **Tringa glareola** (L). The Wood Sandpiper.
A winter visitor, but not very common.

172. **Tringa ochropus** (L). The Green Sandpiper.
o ? November 11, 1925, ♀ November 25, 1925, Peshawar.

173. **Tringa totanus** (L). The Common Redshank.
Numerous in winter.

174. **Erolia minuta** (Leister). The Little Stint.
A winter visitor, never very numerous.

175. **Scolopax rusticola** (L). The Woodcock.
Not common, but occasionally seen in woods in January.

176. **Capella gallinago gallinago** (L). The Common Snipe.
♀ December 4, 1925. A common winter visitor.

177. **Rostratula benghalensis benghalensis** (L). The Painted Snipe.
'My collection contains two specimens shot at Peshawar, and sent to me in the flesh under the impression that they were Woodcock.' (Whistler).

178. **Chlidonias leucopareius** (Temm.). The Whiskered Tern.
Numerous in winter, and possibly a resident.

179. **Gelochelidon nilotica.** (Gmel.). The Gull-billed Tern.
One which had been captured by villagers just outside Peshawar was seen by Briggs on September 1, 1921.

180. **Sterna seena** (Sykes). The Indian River Tern.
Resident on the Kabul River.

181. **Sterna melanogaster** (Temm.). The Black-bellied Tern.
Resident on the Kabul River.

182. **Rhynchops albicollis** (Swains). The Scissor-bill.
Found by Briggs in large numbers on a sandbank in the Indus opposite Attock on April 24, 1923. From the behaviour of the birds it appeared that they had eggs, but a prolonged search failed to discover any.

183. **Ardea cinerea** (L). The Common Heron.
Fairly numerous on the Kabul River at all seasons.

184. **Egretta alba** (L). The Large White Egret.
Occasionally seen on the Kabul River.

185. **Ardeola grayi** (Sykes). The Indian Pond Heron.
♀ December 8, 1925. Common and apparently resident.

186. **Nycticorax nycticorax** (L). The Night Heron.
Commoner in summer than in winter, but noted at all times of the year.

187. **Ixobrychus minutus** (L). The Little Bittern.
One was seen by Briggs on July 26, 1920.

188. **Botaurus stellaris** (L). The Bittern.
Occurs in most of the swamps in tall bulrushes.

189. **Cygnus cygnus** (L). The Whooper Swan.
Of the five specimens of this species which have been obtained in India two were shot by Mr. M. Donlea out of a herd of seven, on December 12, 1910, near Dera Momin, on the Kabul River. (Stuart-Baker, *Game Birds of India*, vol. i, p. 16.)

190. **Cygnus bewicki** (Yarrell). The Bewick's Swan.
Of the two specimens obtained in India one was shot by Major P. C. Elliott-Lockhart near Mardan, on December 30, 1910 (loc. cit. p. 21.)

191. **Cygnus olor** (Gmel.). The Mute Swan.
One was shot about the end of March, 1910, by Capt. H O'Brien at Nowshera. It is of interest to note that all the above-mentioned specimens of Swans obtained in the Peshawar District were obtained in the same year. (loc. cit. p. 26).

192. **Anser anser** (L). The Grey Lag Goose.
Fly over in very large skeins in autumn. In spring they appear to collect on the Kabul River previous to going north. Briggs notes that the two occasions on which Geese flying south seemed to be most plentiful were after rain He says :—' On August 25, 1922, there was thunder and rain in the hills in the evening. From 9 p.m. to 10 p.m. Geese in large numbers were passing over in a southerly direction almost continuously. The following year rain fell on August 22 and 23, from 9 p m. on the latter night till I went to sleep large numbers of Geese were passing overhead. Each of these entries represent the first record of Geese for the year. In none of the other four years for which I have records are Geese noted earlier than September 4.'

193. **Dendrocygna javanica** (Horsf.). The Lesser Whistling Teal.
Briggs records that he saw a small flock on October 12, 1922.

194. **Casarca ferruginea** (Pall.). The Ruddy Sheldrake or Brahminy Duck.
Fairly numerous in winter.

195. **Anas platyrhyncha** (L). The Mallard.
Numerous in winter on the Kabul River.

196. Mareca penelope (L). The Wigeon.
Not numerous, but a few are shot every winter.

197. Nettion crecca crecca (L). The Teal.
Common in the winter on the larger jhils and streams.

198. Marmaronetta angustirostris (Ménétries). The Marbled Duck.
This species was obtained by Logan-Home near Nowshera. (loc. cit. p. 243.)

199. Nyroca rufa (L). The White-eye.
A winter visitor to the Peshawar Valley, but never very numerous.

200. Oxyura leucocephala (Hartert). The White-headed Duck.
Four specimens of this species have been obtained in the Peshawar Valley. (loc. cit. pp. 304, 305.)

201. Merganser merganser orientalis (Oates). Tho Eastern Goosander.
' . . . I have received them or known for certain of their having been obtained from the Peshawar Valley.' (Hume, quoted in loc. cit. p. 319.)

202. Podiceps ruficollis capensis (Salvad.). The Little Grebe.
Fairly common in the Peshawar Valley.

There can be little doubt that other ducks besides those included in this last occur in the Peshawar Valley, but, beside those observed by Osmaston and Briggs, only such species as are specifically mentioned in Stuart Baker's *Game Birds* as having been obtained in the district have been included.

MODERN MUSEUM METHODS

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PART II

(*With two plates.*)

(*Continued from page 544 of this Volume.*)

CHARACTER AND ARRANGEMENT OF EXHIBITS

The more generally accepted method of exhibiting Natural History specimens is to arrange them in cases in accordance with their respective orders, families and genera, classification being the basic principle which governed the arrangement. The system adopted is an heirloom of the days when no distinct line of demarcation was recognized between the reference or study collections of a Museum and its show collections. The attainment of a clearer concept of the aims and purpose of a Museum as an institution for research and popular education necessitated a change in the treatment of its collections. Such exhibits from the collection as were suitable for purposes of display were installed in the Public Galleries while the main portion of the collection was closely reserved in rooms accessible only on application by students and research workers At the same time the exhibits shown in the public galleries continued to be arranged and divided in much the same manner as those stored in the study collection, i.e. they were shown for the most part as individual exhibits arranged according to their respective orders, families and genera. This classified series was usually supplemented with additional material illustrating various phases such as structure, modification, habits, etc., which formed an index or introduction to the study of the main exhibit. To sum up, the specimens with their labels formed an illustrated text book or guide to the study of Natural History and revealed the extent to which science had progressed in the study of these subjects, and the principles on which this study was based.

The exhibits in the public galleries of a Museum arranged as above indicated, are intended for the layman. Their arrangement is based on principles which are the outcome of knowledge gained by men who have made a special study of the subject and are endeavouring to hand down to the public at large the knowledge so gained.

The exhibits as planned have a powerful teaching value; their effectiveness for the purpose, however, depends largely on how the visitor uses the material the Museum has to offer. The teaching of the Museum is silent teaching—a teaching which demands an effort on the part of the visitor for whom it is intended. How far is this effort on the part of the visitor forthcoming and how far is the influence of the Museum's teaching carried to the general body of visitors? We might liken the visitor to a Museum to a traveller in a strange country. The traveller who has previously acquainted himself with the traditions, manners and customs of the country he is visiting has his mind prepared to benefit by the impressions he gains by his visit—he might be likened to that class of visitor who, by his knowledge of the principles and motives which underlie the arrangement of the collections in the galleries, is able to understand and appreciate them and to benefit by the lesson they convey. For this quite small class of visitor a collection so arranged is sufficient to provide what is required. A second class of traveller who arrives in a country without any knowledge concerning it, but yet makes an effort during his stay to acquaint himself with the fresh view-points it offers, may be likened to that still smaller class of visitor who, realizing there is something to be gained by a visit to the Museum, makes an effort to absorb somewhat of its teaching: to this class the Museum has still something to offer. Lastly there is that large class of people who travel mainly for pleasure or amusement. They may be likened to ninety per cent. of the visitors to a Museum who visit it mainly from the same motive, quite often because there is nothing better to do, or to keep out of the wet, or for some such reason: people who not only lack knowledge but also the inclination to acquire it, and who form undoubtedly the largest proportion of visitors to a Museum. For them the teaching the Museum has to offer loses most of its force unless that teaching provides something which can arouse and hold their interest and lead them to absorb, unconsciously perhaps, somewhat of the message it intends to convey. A visitor of this type passing through galleries of named and classified animals comes away at the most with the impression that there are a great number of different animals in the world. The special, laboriously prepared cases illustrating particular phases of animal life, labelled in terms he cannot possibly hope to understand, hardly bother him at all, as conscious of his shortcomings, he probably does not even look at them. It follows therefore that the teaching value of the exhibits in such a Museum is lost on the majority of its visitors.

One of the main objects of a Museum being the diffusion of knowledge, the measure of its success will depend largely on the ability of the Museum to drive its message home to the largest number. We are teachers not as a right but only when that which we teach is effective in influencing those whom we teach. If we are invariably confronted by indifference, boredom or even hostility, then we have failed in our objective. If we are eager to capture the interest and enthusiasm of people, to get them to think and work along with us, and are able only to capture indifference, it is obviously necessary for us to address ourselves correctly to the problem before us, not by talking vaguely about goals and ideals but by finding out quite specifically which methods are to be employed if we are to 'get across' to capture attention, to win regard and induce people to think and act along with us.

The classes of visitors for whom the Museum must provide are :

(1) The Research Worker.
(2) The Student.
(3) Those who visit the Museum without any definite object.

The Research Worker.—The needs of the research worker do not enter into the present discussion which concerns itself exclusively with that part of the Museum collections which are accessible to the general public. The research or study collections of a Museum which are intended for professional or advanced students are installed in rooms to which the general body of visitors are not admitted, and their installation and preservation present problems distinct from those which arise in the treatment of the exhibits in the public galleries.

Students.—As regards the student visitors, one might divide them roughly into three classes : (*a*) University Students, (*b*) Primary and High School Students, (*c*) Members of the general public who are interested in Natural History.

University Students—The needs of the University student are particular and distinct from those of the general body of visitors. He is entering upon an academic study of Zoology which cannot be followed on the broad lines in which Natural History as a whole is treated in the galleries of the Museum. A practical course of Zoology as prescribed for University students implies the detailed study of particular types of animals which are representative of a given group—this study of a particular animal in the totality of its organization enables the student to compare its parts and organs with those of kindred species and helps him to arrive at an understanding of the distinctive characters of the group as a whole and the characters special to the example itself. He thereby obtains an idea of the connection between comparative anatomy and classification, the significance of family, of generic and specific characters.

The students' needs could therefore be met by a specially selected collection of representative types, the details of whose internal and external anatomy are illustrated by actual specimens, models, diagrams and then labels. These types could be arranged in their correct relationship so as to furnish the student with material necessary for the study of a particular group, and at the same time afford him a synopsis of the animal or the vegetable kingdom as a whole. As a supplement to the main exhibit he would require a series of exhibits whose object would be to explain and illustrate by actual specimens, diagrams, etc., the various technical terms used in Zoological description. A collection of this character while it is invaluable to the student entering upon the serious study of a complex subject, goes considerably beyond the needs of the general body of visitors, for the majority of whom it would hold little interest. Such a collection would therefore best serve its purpose by being kept in a room or rooms which are outside the main stream of circulation of the general body of visitors. For the greater convenience of students and for obtaining the seclusion and quiet that is necessary, admission to these rooms should preferably be by ticket. For greater facility, students should be able to obtain admission cards from the teaching staff of their colleges, while members of the visiting public, desirous of doing so should be able to obtain them from the check rooms at the entrance to the Museum building.

The students' room at the Edinburgh Natural History Museum might be taken as an example of how a collection of this nature should be arranged. A series of vertical cases lining the walls of the room contains carefully selected representative types, classified according to correct sequence, affording a conspectus of the various phyla of the animal kingdom from Protozoa to Man. The exhibits consist of actual specimens, where necessary of enlarged models and of diagrams and labels which are arranged to illustrate the bearing of comparative anatomy on classification. A series of supplementary cases with carefully labelled specimens and diagrams serve as an index to the technical terms used in the description and labels of the main exhibit. The very careful and attractive manner in which the material in this room has been prepared and presented is not the least part of its value as an educative exhibit. The methods adopted in the treatment of a collection of this nature, the design and fixtures of the show cases, the colour used for backgrounds, mounts and labels, the care bestowed in the preparation of the specimens and the methods of labelling, all have a powerful influence for repulsion or attraction. The response obtained from the visitor in examining the exhibits in a museum gallery is similar to the effect produced on the on-looker at a shop window : he may be repelled by a crude display or attracted by an arrangement carefully conceived with the purpose to please. In fact, in the presentation of their treasures, Museums can learn much from the persuasive methods of the window display artist.

Primary and High School Students.—To meet the needs of primary and high school students, many Museums in America, both of Natural History and Art, have adopted the idea of the Children's Museum—a series of rooms in the building, or perhaps an annexe to the building itself, which is devoted primarily for the use of the children. Miss Anna Billings Gallup, Curator-in-Chief of the Brooklyn Children's Museum, the pioneer and perhaps the most successfully conducted institution of its kind, has defined for me the policy and ideals of her Museum. She said that its purpose was to give the children experience with real things, objects of beauty and scientific interest. An atmosphere of friendly hospitality and of understanding of a child's point of view was the basis of all its activities. Through its door children are invited to enter freely and enjoy the story-telling exhibits prepared especially for them. Objects are put into their hands to be handled, admired and compared, arranged, discussed and rediscussed. Games played with objects on display enter into every-day's programme and help to bring into action new ideas in Museum experience which are helpful both to the children and to those who guide the Museum's activities. In providing for children's needs there is wisdom in learning from children what these needs actually are. A trained guide presides over these activities, whether they be in relation to a group or an individual, and endeavours to bring his instruction into concord with the school life, the home life and other recreational interests of the child. The child learns to look upon the Museum as a pleasure resort and centre of information. He is even provided with a library organized especially for him.

Briefly the aim and purpose of the Children's Museum is to afford intellectual entertainment and instruction of a better type for children. It aims at arousing their observant powers and offering them new fields, interests, study, new hobbies and teaching them in a way children like to be taught, arousing their interest and putting them into the way of finding things out for themselves with just that little help and encouragement that is needed. The feeling about the institution is that it is regarded by its visitors as something of their very own—something with which grown-ups have very little to do. They are welcomed within its walls and are encouraged to use and handle and study its collections, read in its library such books as especially appeal to them, play its games and enter into its out-door activities. That feeling of awe and restraint which inspires the child during a visit to a Museum is not encountered here.

The staff in direct control of this section of the Museum is chosen with care, the selection being governed as much by the capacity of the candidate to 'handle' children as by his or her own knowledge and ability. 'We find out so much about the child here,' said Miss Gallup to me, 'we find out the observant children—the child with a penchant for independent enquiry and the child who is careless at observation. Such a one, given a series of questions, will come back with only half of them answered. He or she is encouraged to go back and study the objects until the whole is revealed. Sometimes we find that a child has no colour sense at all—cannot distinguish between reds and blues. The child's needs are two-fold, mental and physical. The Children's Museum tries to provide for both of them.

During the past year, in the Prince of Wales' Museum we have had for the first time the fortunate experience of handling some 6,000 children and have come to realize something of the interest and enthusiasm which can be engendered in them by an effort directed to meet their special needs.

To come to the more practical side of the question and to illustrate how a Museum may serve its younger student visitors, also those among the general public whose interest is not merely superficial, I do not think that I can do better than by taking the Children's Museum at Brooklyn as an example of how the work may be carried out. The Children's Museum at Brooklyn has served and assisted in the founding of Children's Museums in many foreign countries or in adding them as real departments to already existing institutions. It has been a source of inspiration in the work we are attempting to do here in Bombay, and I gladly pay this tribute to Miss Gallup, its genial Curator-in-Chief for the help and encouragement I received at her hands during my visit to her institution.

The Children's Museum at Brooklyn is situated in what was once a residential building in a small public park. Its collections are arranged to meet the following purpose :—

(A) To provide a general outline of the animal kingdom by a especially arranged collection of types illustrative of various classes of the animal kingdom, in order to supply a foundation for the study of the subject by making the visitor familiar with the appearance and characteristics of the principal animal classes.

(B) To encourage an interest in Natural History and provide material for its study by the exhibition of a series of exhibits representative of the local fauna and flora.

(C) To extend its teaching to the study of the earth's crust by providing exhibits illustrative of the various minerals of which it is composed.

(D) To co-ordinate its teaching more helpfully with instruction the child is given in the schools by the inclusion of exhibits illustrative of History and Geography.

To sum up briefly the collections are divided into a Zoological and Botanical Section, a Mineral Section and Historical and Geographical Sections.

THE TYPE COLLECTION

Zoology is set forth in a type room of ample dimensions located on the first floor. The various classes of the animal kingdom are presented in specimens, drawings, pictures and models, assembled in cases that line the wall and occupy the central floor space. Beginning at one side, the sequence of development is carried around the room and down and up the central cases so that the skeleton of man, the highest unit, faces the opening study of the amœba. One large label for each sub-phylum or sub-kingdom is fastened on the glass front of the case and similar labels of uniform, smaller size are provided for each class. Strips of moulding carried down the back wall of the case and across its base separate the phyla ; black cords outline the minor divisions thus, by size of label and width of outline the observer will know at a glance which groups are co-ordinate. Another distinguishing feature is the color of the bases or pedestals of the exhibit for all the lower forms, for creatures whose habitat is the water or the sandy shore, they are grey—for the mammals they are black or very dark. The labels and their frames are similarly distinguished. In the whole arrangement the display is restricted only to such specimens as will show in clear outline the important successive stages in the development of the subject. Excessive detail is avoided as this is confusing to the youthful mind. Pictures are used to show tiny forms many times magnified, and to explain a label further or to represent some form absent from the sequence, some form which must be listed because children are interested in it, such as the elephant among the Ungulates, an order sufficiently represented in the exhibit by two specimens.

The labels are mostly couched in popular language but as is generally unavoidable in labelling a type collection scientific nomenclature will sometimes predominate and the direct appeal of the label to the child will consequently be lessened. This is where the work of a docent or guide is most welcome. While the Zoology collection as a whole is for pupils of the higher grades, the teacher of any lower grade may feel sure that her pupils will receive much benefit from a visit to the museum. For very young children the description specializes in well-known animals and calls attention to colour, beauty of form, and other striking characters. The guide thus finds something to interest and instruct the child whatever its age or grade may be till the story of the Ascent of Man is almost unconsciously learned. The lecturer makes a point of talking about just such exhibits as the child himself has recognized, talking about these first and then going on to other familiar animals, he is able to give the child a desire for more ' stories '. The child asks questions and learns more about the exhibits, and gradually acquires knowledge of many animal forms, knows something of classification, and story of the Evolution of Man. The important point in the arrangement of a systematic collection on the above lines, is that the collection should be kept as small as possible. The inclusion of an excessive number of exhibits only tends to confuse the issue ; it should be limited to the inclusion of such well-marked forms as will suffice to indicate the limit of variation in a particular class of animals and illustrate the inter-relationship of the animals included in that class. One should always bear in mind that one is providing for the amateur and not for the professional.

LOCAL BIRD LIFE

A second series of exhibits illustrates the bird life of the local park. The birds are attractively mounted, shelves are not used as they tend to produce a monotonous line in this form of exhibition. The birds are fixed to the walls of the case on brackets and are arranged in cases according to the season during which these birds can be seen in the park. Thus you have cases of permanent residents, of winter residents, occasional visitants, summer birds, spring and autumn migrants. The series gives a graphic idea of local bird life as it illustrates species which can be actually seen in the child's neighbourhood. The importance and the value of an exhibit illustrative of the local fauna, is too obvious to be stressed. An interest in nature and later in natural history commences or arises from an interest in the animal or plant life of ones immediate neighbourhood, and a collection of this description will not only supply the stimulus to this interest but will also help in its development. In addition, such a collection will meet the requirements of those whose main object in visiting the museum is to identify some animal or bird they have seen in their vicinity.

THE INSECT ROOM

This room contains an attractively mounted and displayed series of insects in wall cases which illustrate various features of insect

A Lesson in Minerals
Children's Museum, Brooklyn, N.Y.

By courtesy. *Children's Museum, Brooklyn.*

THE CHILDREN'S MUSEUM

The Vivarium is a Great Centre of Attraction to Young Visitors.

A Corner of the Well-used Library.

By courtesy. *Children's Museum, Brooklyn.*

life. The collection being intended for children, color and beauty of shape have influenced the selection of specimens for illustrating the various studies, but at the same time the exhibits are arranged on scientific lines so that their full educational value is maintained. The child can here become familiar with local moths, butterflies and beetles. A silk worm and silk exhibit, a hive of living bees and many species of insects that do harm to local trees and crops are included in the series.

THE MINERAL ROOM

The Mineral Room of the Museum is one of its most popular features. It is divided into two sections—a series of students' trays containing labelled examples of minerals which the child can examine and handle in a way that children like to do, and a corresponding series of finer specimens which are included in the main exhibition. The object here is to give the child a good working knowledge of minerals. Mineralogy would usually be considered a dry as dust subject for the child, but when attractively presented young people quickly become quite enthusiastic over the science and few types of lone material are more in demand at the Children's Museum than the trays of rocks and crystals, while the mineral and volcano room swarm with little folk. Mineral study seems to have become a tradition with the Museum, and it has developed a department which numbers now among its alumni a mining engineer, a mine operator in Mexico, and the late Curator of Mineralogy at the Public Museum at Milwaukee. All these found their first interest in minerals in the rooms of the Children's Museum at Brooklyn. Although the function of a Children's Museum involves cultural rather than professional training, it augurs well for the subject concerned when such results are obtained.

THE BOTANICAL SECTION

This section includes cases which form an introduction to the study of Botany, the various parts of flowers and leaves, etc., are explained in models and pictures.

THE HISTORICAL SECTION

American History occupies five sections, European sovereigns and navigators, American, Indians, settlement and colonial period, the Wars, New York State and City, outlining significant events in national development, all these are set forth in charmingly realistic miniature groups or paintings.

THE GEOGRAPHY ROOM

Outlines primitive life in all parts of the world, polar scenes, jungle and desert, illustrated in minature groups.

THE LIBRARY

The Library in the Children's Museum contains 7,500 carefully graded and selected books. It is open during the same hours as the Museum, i.e. 9 a.m. to 5.30 p.m. weekdays, 2.30 to 5.30 p.m. Sundays. It is a pioneer library in its own field and has a share in all the activities of the Museum. It is one of the best and most complete nature libraries in the country, and its books cover a wide range of additional topics, such as travel, history, biography, mechanics and inventions which appeal to the interests of the child. The number of readers exceed 60,000 each year, and quite frequently there are from 400 to 600 children visiting the library in a day. At such time, of course, the children come in relays. The library occupies two rooms, a home-like cheery room for children, and an adjoining reference room for teachers and older students. As far as possible individual attention is given to the readers, first assisting them in the selection of books and leading them to a love of good reading, and second teaching them to get reliable information from books. Information is offered about all the exhibits found in the Museum, and pictures, collections of poems and plays and other data are provided in connection with school studies. The boys and girls who have been working industriously for a certificate of credit from the Museum in animal study, history, geography, or some such subject, come to the library in search of information on a variety of subjects such as protozoa and amphibia, animals found in the South Sea Islands, trees and vines of Brazil, and the Berbers of the Sahara Desert. Again the librarians get inquiries from children about their own city. On such topics as the different types of bridges in New York and their construction, and how the subways and tunnels are built. To show how the library is being used by the children I might say that a girl composed a little play entitled : 'Christmas in Mother Goose Land,' which her classmates supplemented with poems found in the library. Needless to say, the library offers considerable attraction to Boy Scouts and Girl Guides. They come in to identify flowers, birds' nests, mushrooms and shells, and to inquire about aquaria, snakes, and a number of things which interest them.

Among the library's activities is the holding of exhibitions of paintings and pictures appropriate to time and season, thus the birthdays of Washington and Lincoln were the occasion for the display of pictures relative to the life of these men, and attendance at these exhibitions is always very large. In this way books and periodicals were used by hundreds of boys and girls, quite a large number of whom wanted books and stories about these national heroes. These patriotic pictures attract the children and even the adults, while reproductions in colour of paintings representing scenes in the history of the country give them an idea of the story of their land and what it means. In connection with these pictures the library posts up lists of plays and pageants, flag drills, etc., appropriate to the celebration of America in the making. There is also a list of stories of countries, comprising titles of books about eighteen European countries which had some share in the growth of America. I have written at length on the activities of this library because it is not usual to find work of this nature in institutions such as these. The policy adopted by the Children's Museum Library shows just how very active and helpful a library can be and to how many different fields of interest and endeavour it can lead its users.

EDUCATIONAL WORK

Musuem Courses

Opportunity is given to the children to work at the Museum in eight different subjects represented by its collections. A student may begin to work at his convenience and spend as much time as he pleases on any course. The whole thing is left to the will of the child and no blame whatsoever attaches to him if he stops off and fails to complete a course. 'We leave them to develop their ideas by themselves,' said Miss Gallup. 'Sometimes they tire of a thing, and leave off; but mostly they come back again.' The completion of each course entitles each child to a certificate of credit which counts towards a medal. A bronze medal is awarded for fifty credits and a silver medal for a hundred credits. Courses may be chosen in any order. The courses and amount of credits against them are as follows:

A child desiring to take a course in Minerals applies for a leaflet giving the requirements for a certificate in mineral study. He then asks for a 'model notebook' on mineral study which gives him directions how his own notebook is to be kept. In answering the questions he records his description in pencil in his own notebook. He gets from the library a book on minerals and from the docent a streak plate for testing minerals, a box of minerals giving the scale of hardness of various minerals, and the first student's tray of minerals containing twenty named important minerals in compartments. Each compartment bears a letter and a number which corresponds to those on the specimen and in addition the name of the mineral and its chemical composition is attached to the compartment, i.e., the first tray is A, the first compartment would be A1 and below it is a label marked "A1 iron pyrites, Fe S2." With this equipment the child commences the study, his note book must be the record of his own observation. He must not crib from a text-book and the value of the work to him will depend upon his own independent action. The book is only to be used as a reference—if he cannot find the answer to any question at once about any particular specimen he is recommended to leave a blank, for in some later tray he will probably find a specimen which will give him the information he is after. It necessarily follows that the first specimen and the first tray take quite a long time to do, but once he gets into the way of working, things become easier for him. After completing A^1 he takes up A^2 and so on, then he goes on to the B series, where he will find some new minerals and also some duplicates, which will add to the information of those he examined first. After studying the first three trays it is suggested to him that he should mix up the minerals of the next tray and see how many he can identify at sight. I have taken mineral study as an example, but it is obvious that the methods used here can be applied to every other phase of life. The whole objective of the courses is to help the child, firstly, by giving him an incentive to work in the shape of a prize, secondly, permitting him to work independently, to allow him to handle exhibits and find out things for himself, with the least possible assistance. Naturally, these methods give the child an interest in the work by putting him 'on his mettle,' as it were.

Museum Games

Among the features of the museum are the games it organizes for its visitors, games which are both interesting and educational. A child wishing to play the 'bird game' is given pictures of twenty-five birds exhibited in the gallery and he is asked to go out and pick these out. The next stage is to give to him twenty-five names and tell him to find these birds in the collection; in this way he becomes familiar with quite a number of birds and is able to tell them at sight. There are various games of this type covering various phases of animal life adapted for children of various grades. A child who can identify twenty-five birds is allowed to take a stuffed specimen in a small glass case home for a few weeks. He has learned everything about this specimen and tells his people about it, and takes it to school and tells his classmates about it. They in their turn get interested and want to have a bird of their own and so the interest in the museum spreads.

Stereoscopic Views

Every afternoon during the week a crowd of from twenty to fifty children congregate in the History Room where a dozen stereoscopes and a store of views are brought out under direction of the museum attendants and placed at their disposal. Geographical views, pictures of wild birds and flowers, prove particularly popular, and more than six hundred children enjoy the use of these stereoscopes each month.

(*To be continued*)

1. A HANDBOOK OF THE BIRDS OF EASTERN CHINA, (Part IV). By J. D. D. La Touche (Taylor and Francis, London; 7*s*. 6*d*. net.)

We have already had the pleasure of noticing the publication of the first three parts of Mr. La Touche's *Handbook of the Birds of Eastern China*, and now have to welcome the appearance of Part IV, dated August 1927. This deals with the families Ploceidæ, Fringillidæ, Bombycillidæ and Hirundinidæ which are well represented in India; indeed many forms described by Mr. La Touche are identical with our Indian birds, whilst others are closely allied to them.

Two new races are described in this part, *Emberiza cioides vagans* (type locality Amur Bay) and *E. c. fohkienensis* (type locality Foochow). It is interesting to note also that the author accepts Dr. Sushkin's opinion that *Emberiza godlewskii* should be treated not as a race of *Emberiza cia* but as a separate species with races of its own.

A new feature in the present part is that under various species the author includes a brief resume of the races, including extra limited forms: this is undoubtedly useful. It is a pity however that the plumage descriptions are somewhat irregular in method of treatment. Some are very diffuse and tend to become almost a catalogue of specimens in the author's collection; others err by incompleteness, mentioning only a single sex. All the same we are able to congratulate the author on the completion of this further instalment of his book, which will be of the greatest possible value to all who are interested in Chinese ornithology and especially to those who look forward to the resumption of active fieldwork in China when her present troubles subside.

Indian ornithologists should note that in treating of the Red-rumped swallows (*Hirundo daurica*) Mr. La Touche does not agree with certain details of the distribution east of India of the subspecies *striolata* and *nipalensis* given in the new edition of the Fauna; the study of these swallows in India is very perplexing and a correct estimate of their distribution remains to be written. Mr. La Touche's remarks should therefore be consulted by students of the group.

This part contains a map to be substituted for that already issued in Part III in which an error has been discovered. It also contains four halftone plates to illustrate types of country, and it is interesting how similar much of the country appears to that of India.

H. W.

2. THE LITTORAL FAUNA OF KRUSADAI ISLAND IN THE GULF OF MANAAR WITH APPENDICES ON THE VERTEBRATES AND PLANTS. By Various Authors.

This interesting publication marks the revival of a serial publication—Bulletin of the Madras Government Museum—which, as is stated in the editor's foreword, has been in abeyance since 1907.

The series will hereafter be issued in two sections, the Natural History and General Sections, and the number under review forms No. I of vol. i of the Natural History Section of the *New Series* of this publication. As the general title of the work indicates it deals with the Littoral Fauna of Krusadai Island in the Gulf of Manaar, and is a systematic account of practically all groups of Invertebrates excluding Protozoa, Porifera, flatworms and some of the smaller groups. From amongst the Chordates only the Urochordates have been dealt with, while a list of the Vertebrates generally is included in an appendix. An account of the Flora of the area is published as a second appendix.

The volume has been prepared primarily for the use of the students who will be working in the Biological Station which is proposed to be established on Krusadai Island and should serve as a very valuable handbook. The visits of the students, as is pointed out in the introduction can as a rule only be of short duration, and if full value is to be obtained from them some ready means, by which at least the commoner organisms that will be met with can be identified, must be provided. In Europe this can to a great extent be done with the aid of the many excellent monographs that have been published on various groups. But in India, few such monographs have yet been written. To prepare a complete and self-sufficient monograph of the fauna and flora even of so small an area as that under consideration, with a full account of the classification of every group, would swell the work to an inordinate size with matter which would be largely a repetition of the work of others already published elsewhere. And, however convenient it might be, it would be undesirable ; in as much as it would help to confirm the impression which students so often get that all knowledge is to be found between the covers of their text-books. On the other hand, to write an account which could only be followed by specialists or with the aid of books that cannot, for some time at least, be available on the island, would be to defeat the object of the work. We have therefore followed as far as possible the classification set forth in some standard text-book such as the Oxford and Cambridge Natural Histories. The particular book followed has been mentioned under each group and should be consulted for details. As, however, only the broad outlines of classification are dealt with in such books, reference is given to other works that have been found helpful in connexion with more detailed classification, and it has usually been necessary to insert a brief account of the distinctive characters of such of the smaller subdivisions as are represented in the collections. These have been kept as short and clear as possible, only the most useful characters being included. But keys have as a rule been avoided on account of the sense of completeness and finality which they are apt, often falsely, to convey. Descriptions of species have also been kept as brief as possible, especially in the case of those already described in the publications of the Indian Museum, in Alcock's 'Materials for a Carcinological Fauna of India[1] (1895–1900), in

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[1] *Journ., Asiatic Soc., Bengal*, 1895–1900.

Stanley Gardiner's 'Fauna and Geography of the Maldive and Laccadive Archipelagoes', in the reports of the Percy Sladen Trust Expedition to the Indian Ocean[1] and in Herdman's 'Report on the Pearl Oyster Fisheries of the Gulf of Manaar', works bearing in so definite a manner on the fauna under consideration that they must obviously be available for reference along with the standard text-books already mentioned in the library of the Krusadai biological station.

The different chapters dealing with the various groups have been written by different authors, but the greater part of the volume is the work of Dr. F. H. Gravely, Superintendent of the Madras Museum, who has also acted as the editor for the remaining contributions, and Dr. B. Sundara Raj, Director of Fisheries, Madras. In each case the commoner forms met with have been dealt with in sufficient detail for identification and very instructive line and dot drawings of the species have been published. Fairly extensive literature references have been included at the end of each chapter and these with the work under review should enable students to identify most of the commoner forms, which are found in the region.

A general description of the island and other collecting grounds in this region together with maps of the different parts is also included.

The work is by no means the last word on the subject and as the editor remarks will need revision after the various groups have been revised by specialists.

The editors and the authors, however, deserve the thanks of students and incidentally of others interested in Marine Biology on producing a really useful handbook on the littoral fauna of the island and the adjacent parts, and it is sincerely hoped that it will stimulate more detailed research on Indian marine fauna of the region.

The printing and general get up of the work is really excellent and the price (Rs. 8) for a work of its size with 26 plates, is by no means exorbitant.

B. P.

3. WITH A CAMERA IN TIGER LAND. By F. W. Champion, M.A. (Oxon) F.Z.S.. Imperial Forest Service of India. [Chatto & Windus, London, 1927. Price 30*s*. 228 pages, 73 illustrations.]

Books dealing with sport and the natural history of the fauna of India have hitherto almost without exception, been conceived and written with the object of describing the methods and adventures which lead to the destruction of animals.

In his book *Wild Animals in Central India*, reviewed in this Journal (volume xxix, page, 1032) Mr. Dunbar Brander rightly remarks that when not bent on slaughter, one sees and observes far more of the animals of the forest. Mr. Champion advances us much further than that, and in the book before us, which he correctly claims to be 'the first book ever published which is illustrated throughout with photographs of wild animals just as they live their every-day lives in the great Indian jungles', does a real service to the wild animals he loves so well, for we venture to predict that an increasing number of sportsmen will endeavour to live up to his teaching and example.

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[1] *Trans. Linn. Soc. London* 1907 onwards.

'It is better' we have recently read somewhere 'to hold the hand of Nature and to look into her eyes than to alienate and slaughter her.' That is the spirit in which this book has been conceived and written.

The first three chapters give us charmingly written pictures of 'A Day in the Jungle', 'A Night in the Jungle', and an account of what is truly described as 'An Extraordinary Experience'. Those of his readers who have had the fortune to wander on elephant back through the submontane forests of the Himalayas, must vividly recall to mind days similar in a general way to that so faithfully presented to us. The coming upon the tiger and his kill has happened to some of us, but to few of us has been vouchsafed the sight of the wild elephant: and it is quite certain that no one of us has photographed him in his natural surroundings as has our persevering author.

The extraordinary experience related in Chapter iii must be quite unique, and such photographs as plates xv, xvi, xvii, are unlikely to be again obtained.

We take the volume in the order in which it is arranged, but keep the elephant to the last. With the chapter on monkeys there are seven excellent photographs depicting the common Brown or Bengal Monkey and the Langoor, these being the two species of primates found in the forests of the United Provinces. With the remarks of the author as to the 'cruel iron bars' of the cage of capitivity most of us must be wholly in accord, and we hope that the time will come when such things will be condemned by public opinion.

Mr. Champion expresses himself as absolutely convinced that a langoor, if he calls four or five times, does so because he can actually see a tiger or a leopard. On this point we would remark that we have seen langoors give the alarm call at sight of a yellow dog-and this not once only but on several occasions—while the smaller monkey never took any notice of it. Otherwise also, in our experience, the langoor is less reliable than his smaller relative, who never deceives the sportsman. The aboriginal tribes of India recognize that the langoor is not always to be relied upon and will give the alarm when *rhesus* would not. Both species provide excellent training for the would-be photographer of animal life in the forests.

Of tiger in general the author writes with the knowledge born of careful observance, and has much that is interesting to relate. He rightly concludes that the sense of smell possessed by tigers is weak: 'practically non-existent' in his opinion; but we would not put it so low as that, and would say that it is not more highly developed than that of man.

As to the 'twelve-foot tiger' the 'probability' that many of these lengths were taken from skins after they had been removed from the carcasses was amusingly confirmed to us only three years ago. A sportsman who shot three tigers in one beat reported the fact to the civil officer of the District, stating in all seriousness in his letter that the animals he had shot measured 13 ft. 6 in., 12 ft. 9 in., and 11 ft. 7 in., respectively. It was ascertained that these lengths were obtained by taping the fresh skins, pulled out serpent-wise to their fullest extent! That method of measurement is no doubt the orgin of the 'twelve-foot' tiger.

The sport of photographing tiger is fully described. The author, having fixed for himself the high standard of obtaining photographs of animals under strictly natural conditions, and 'not where he is the pursuer or pursued', rules out the employment of beating for the production of photographs of tigers; and explaining that he has never yet had a tiger come near a machan in daylight, in a light good enough for a picture to be produced, he proceeds to describe two other methods.

One is 'ghooming' (not 'ghumming') an anglicized colloquialism of a Hindustani word, or wandering about in hopes of a 'subject'; and the other the stalking of a tiger on his kill. A well-trained elephant, with an equally well-trained mahawat (we like that spelling of the word) is essential to either method. But the experience of the author, after years of continuous effort, is that but few pictures are obtained in proportion to the amount of energy expended; and he comes to the conclusion, which is borne out by the vivid 'action' of his flashlight photographs, that this is the best method of all.

Success, however, the author remarks, is only to be obtained by dint of perseverance and determination to succeed in spite of repeated failures and the risk of contracting severe attacks of malarial fever. In some other parts of India the fever risks would not be so great. Justly, however, can the author claim that automatic flashlight photography is 'not too easy to be sporting'.

In the enlarged copy of the head of the tiger of plate xiv, xxi which forms the frontispiece of the book, we see the size to which the pupil expands in the dark and can realize how it is that, however fine the trip-wire may be, it will most likely be detected, as is shown at plate xxx. Also we realize the delight of the author when he developed this plate!

We are given an interesting chapter on tigers and their prey, the author coming to sound and right conclusions on this as on other matters he discusses. Tigers do not always seize their prey in the same manner. 'Circumstances alter cases' and, as indicated by a photograph on p. 587 of Vol. xxxii of this Journal and witnessed by the present writer under electric light, a tiger, when the prey is easily within his power, does not necessarily break the animal's neck, but seizes it in a vice-like grip until life is extinct.

In these days of modern photography the aim of all enthusiasts is to obtain a photograph of tiger in the act of killing his prey. Mr. Champion has not yet succeeded in obtaining such a picture and it can be fairly safely asserted that only by cinema photography, carried out by daylight under previously prepared conditions, will such a photograph be obtained. Nevertheless we hope that our persevering author's efforts in this direction will be crowned with success.

Of leopards and the smaller cats we are given some excellent pictures and interesting reading. It is remarked that in the detection of the trip-wire, however fine it may be, the leopard is even superior to the tiger. That is an instance of knowledge coming to us through the photographing of animals in their natural surroundings.

The author might, with accuracy, have asserted more positively that the leopard cat is less common than the jungle cat (*Felis chaus*).

The photograph at plate xxxiv is that of the Small Indian Civet (*Viverricula malaccensis*) and not of the Large Indian Civet (*Viverra zibetha*) as it is without the distinctive *Viverra* crest along the spine.

Under the heading 'Hyænas and Others' we see pictures of hyænas and jackals only. The absence of a photograph of the animal popularly known as the wild dog is to be regretted ; but, as the author says, it would take many, many years successfully to portray photographically all the interesting creatures of the jungles.

Mr. Champion is correct in stating that there are large numbers of hyænas in the forests. They are very common animals. We are at one with the author in doubting that a leopard will abandon his kill to a hyæna, also we agree that the hyæna of the forests is a particularly silent animal. The killing of tethered goats by hyænas is within our experience, also we have personal knowledge of a hyæna having killed and eaten a woman and a boy and attacked another woman.

Of the rodents, photographs of the Indian Palm Squirrel and of the porcupine are given. In view of the certain knowledge we have that leopards frequently kill porcupines for food it is not probable, as the author remarks, that they often inhabit the same dwelling.

Of the deer tribe we have good photographs of the stag and hind chital, but none of the noble sambur stag, or of the ubiquitous barking deer. The absence of pictures of these animals, so common in the forests known to the author, emphasizes the difficulties in the way of successful animal photography under natural conditions.

Of 'Antelopes and Others' there are pictures of blue bull, and a silhouette of a distant gural ; also a photograph of two wild boars in a characteristic attitude. Mr. Champion is correct in stating that the serow is to be found at elevations considerably below 6,000 feet.

The wild elephant has, perforce, to be photographed by day, and in doing this Mr. Champion has been eminently successful. He gives us much interesting information as to the manners and habits of both tame and wild elephants. Both the chapters are exceedingly interesting, and the photographs among the most striking in the book.

In justice to the author we must touch but lightly on all he tells us and leave the reader to his certain enjoyment of it. He will learn much of what the author terms the fascinating pursuit of photographing wild elephants, will read of some highly exciting incidents, and generally learn much that he did not know before.

The final chapter of the book is on photography. Willing and helpful expert advice on cameras, lenses, plates, etc., is given ; also especially valuable practical instruction as to the flashlight photography by means of which the author has been able to secure, and produce for our instruction and enjoyment, so many excellent pictures.

However, he makes one statement which calls for comment. This is in regard to Marius Maxwell's 'Big Game Hunting with a Camera in Equatorial Africa'. According to Mr. Champion "nearly all his (Maxwell's) pictures were produced with an ordinary 8 in. lens, and strange to say, without a reflex camera". We cannot understand how Mr. Champion can have derived the impression that Maxwell did not employ a reflex camera in face of what that author says at the very commencement of the book, in his lucid and instructive chapter on 'A Camera Huntsman's Equipment' (page 3, para 3). Plate I of this chapter, moreover, depicts the camera chiefly used by Maxwell, which is manifestly a short focus reflex.

We do not know what Mr. Champion's sources of information may be for stating that Maxwell's method of photographing big game was "to stalk up to his subject and then to expose plates at close range, *often by holding the camera over his head and centering the animal by means of a direct vision view finder*". From a perusal of Maxwell's book one certainly does not gain the impression that this method was often adopted. It may perhaps have been only in a very exceptional instance that it had to be resorted to.

Of the game animals of India the author has photographed seven in their natural surroundings and at close range. In the mountains, plains, and forests of India and Burma there are more than thirty-seven! So there is plenty of room for those sportsmen who will abandon the rifle in favour of the camera and preserve pictures instead of horns, and hides, and hoofs, of the game animals of this country. Through animal photography such as is put before us by Mr. Champion, the sportsman will obtain records more permanent than perishable trophies; the naturalist, the sculptor, and the painter will all have pleasure in and profit by his labours.

The duty of a reviewer is to criticize, withholding nothing adverse if such be found; but we close this book with no note of dissent, and feel sure that a wide circle of readers will enjoy it with very deep interest. More especially will it be appreciated by those who themselves know and love the vast jungles of India and have at heart the preservation of their wild inhabitants from useless destruction.

R. B.

4. DWELLERS IN THE JUNGLE. By Lieut.-Col. Gordon Casserly. [Ward Lock & Co., Ltd., London and Melbourne, 1925. 255 pages, 16 full-page illustrations by Warwick Reynolds. 5*s*. net.]

5. IN THE GREEN JUNGLE. By Lieut.-Col. Gordon Casserly. [Ward Lock & Co., Ltd., London and Melbourne. 255 pages, 16 full-page illustrations by Warwick Reynolds. 5*s*. net.]

The stories of animal and bird life in 'Dwellers in the Jungle', given to us by Lieut.-Col. Gordon Casserly, are exceedingly well told and hold the attention of the reader from cover to cover. The word painting of the scenery of the great forests of India is good, the style easy and attractive, and the natural history in the main quite accurate.

We are told of the baby wild elephant and how his mother saved him from the murderous onslaught of a tiger : and of a tame elephant (this being a story built upon an actual occurrence) roaming wild for the best part of a year and returning to her bondage. The use of the word 'galloping' to express the utmost pace of an elephant is misleading to those readers who have not seen this animal moving out of a walk. The two stories of wild and tame langoors are natural to life and realistically told, as also that of the jungle cock and of the weaver bird, and in 'The Warden of the Ford' the way of the man-eating crocodile is faithfully presented to the reader.

In 'The Hated Horde' the story of the wild dog of the Indian jungles is well depicted. The author describes these animals as hunting in full cry, and mostly, though not always, at night. We believe it is a fact that *Cuon dukhunensis* hunts entirely by day, and on the several occasions on which we have actually seen them in pursuit of their quarry they have been running quite mute. No doubt there would be some eager whimpering when the climax of the hunt is reached.

Of the many other natural history incidents, and the like, related to us, we doubt the king cobra attaining a length of 18 feet; and have not before known that the python, or any other snake, first secures its prey by flinging a coil after the manner of a lasso. The hyæna does not wear a perpetual snarl, but, like all other animals, bares his teeth only when he has reason to do so. The term 'buck' we would reserve for the male of the goat species and think it a misnomer for the deer tribe.

With these few criticisms in mind we commend the book wholeheartedly to all lovers of nature study, and the glamour of the great forests of India and their denizens will be with them as they read.

'In the Green Jungle' is not a wholly accurate title as the opening story is that of a camel of the Great Sahara Desert, and a very good one it is. The life of the ubiquitous jackal is excellently well related. The 'Law of the Jungle' is the story of a man-eating tiger. His fitting end is doubltess based upon an actual incident of the kind. Throughout the forests of India are many ancient ruins and what the wild life may be amid some of these is vividly described.

Of the gallant wild boar, the ruthless python, the swift hunting-leopard, we are given absorbing tales. The story of the white ant is good, and in 'The Mockers' the langoor again provides interesting material.

There is but little room for criticism. We would not call the 'Did-he-do-it?' which is a lapwing, a long-legged fowl.

The book is of merit equal to that of the former volume, and we close it with similar commendation to the readers old and young alike.

R.B.

EDITORIAL

We have recently welcomed—and very warmly—another expedition sent out to India to obtain further material for the Natural History Museum in New York, and by careful observation by trained artists in the actual haunts of our big game to learn how best to exhibit the denizens of our jungles to the public of America.

The expedition was organised some years ago by Mr. Arthur S. Vernay, a business man of London and New York and incidentally an enthusiastic big game hunter and naturalist, in collaboration with Col. J. C. Faunthorpe, late Commissioner of the Lucknow Division, United Provinces. Its object was to secure a representative collection of the game animals of the Indian Empire for the American Museum of Natural History, New York. Through the active support of the Government of India the expedition received exceptional facilities for achieving its purpose, with the result that a series of very beautiful groups illustrating the game animals of this country are now being prepared for the Hall of Asiatic Mammals at the New York Museum. To complete the work and in order that the groups of animals exhibited might be shown in their natural setting, Mr. Vernay arranged in December last year for two experts from the staff of the American Museum, Mr. Albert Butler and Mr. C. C. Rosenkranz, a noted landscape painter, to visit India with a view to studying the actual areas where the animals were obtained, collecting forms of plant life typical of these areas and painting pictures and taking sketches of the country in which the animals lived. Mr. Vernay considered that the Museums in India should also benefit by this work and he accordingly very generously invited Mr. S. H. Prater, the Society's Curator, to accompany this expedition and also provided the funds for Mr. K. B. Savardekar our Museum artist, who has painted some excellent backgrounds for groups in the Museum at Bombay, to be a member of the party. Mr. Vernay's generosity has not only enabled the staff to acquire first hand knowledge of up-to-date methods in the field but has also enabled our Museum to secure a very beautiful series of paintings and photographs taken in the forests of India and Burma which will serve as studies for realistic settings for groups which the Curator is now preparing.

In addition to the above Mr. Vernay has presented the Society with a copy of a remarkable film recording the work the Vernay-Faunthorpe expedition in India. Taken at a cost of nearly £6,000, the film records scenes of animal life taken from Nature in the forests of Nepal, Burma, Central and Southern India. Rhinos, Wild Elephants, Tigers, various forms of Deer and even some of the smaller and less known animals of the Indian Jungle play the leading role in this film which is the finest record of animal life ever made in this country.

It is remarkable that a man who has had but a remote connection with this city has seen fit to do so much for one of its public institutions. Museums have been ever dependent for their origin, their growth and development, on private enterprise and on the support of citizens, who take a pride in their city and its institutions. If a stranger can do so much, surely there must be many in this city who would come forward in the same way to help their own Museum if they realised how rapidly it was taking its place as one of the finest institutions of its kind in the East, and how increasingly it was fulfilling its mission as a centre of culture, of popular education and entertainment.

Mr. Prater was away about two months and was accompanied by our artist whom, thanks also to the generosity of Mr. F. V. Evans—one of our Vice-Patrons—we have been able to send on the journey. We say thanks to Mr. Evans as he is providing the salary for a second artist to prepare models of the fish of our coasts and rivers and at the moment this permitted of our sending Mr. Savardekar with Mr. Prater. When in Mysore the party was looked after by one of our members—Mr. R. C. Morris of Mysore to whom our thanks are due.

We are very glad that we were able at the present time to give Mr. Prater and our artist this opportunity, as our hopes of being able shortly to erect a modern

Natural History Museum are steadily increasing. In our last editorial we had the pleasure of thanking Sir David Ezra for his donation of Rs. 5,000. Now we have a similar pleasure in recording a donation of £500 from Mr. Vernay towards the cost of equipping the New Museum. Mr. Vernay thus not only gives our Curator the opportunity of learning how to do it, but provides us with the means to enable the Curator to follow the teaching of Mr. Squeers and having learnt the meaning to carry out the job.

Mr. F. V. Evans who gave us the beautiful model of a fly, enlarged twenty-eight times has followed up his gift by presenting us with similar models of the Anopheles and Stegomia mosquitoes, both the work, as with the fly, of the two sisters the Misses Edwardes. As in the former case, so now, we have to thank the P. & O. Steam Navigation Company for bringing these models out free of freight charges. Possibly because the P. & O. did this in the case of the fly, Messrs. Mackinnon Mackenzie & Co., not to be outdone, took home for us for the London Zoo a live elephant free of freight, only charging for the carriage of *Homo sapiens* who went in attendance. We wonder if any one will present the Zoo with a pair of Rhinos so that we can say to them 'You brought out two mosquitoes free, surely it is not too much to ask you should take back free also two Rhinoceroses!'

OUR NEW CONSTITUTION

A Special General Meeting of Members of the Society was held on January 31, 1928, when the following resolutions were passed :—

1. That it is expedient that the Society be registered as a Society under Act XXI of 1860.
2. That the draft Memorandum of Association and Rules now laid before the Meeting and which were published in the Society's *Journal* of October 20, 1927, be hereby approved as the Memorandum of Association and Rules of the Society.
3. That the Members of the Executive Committee and Advisory Committee therein named be approved.
4. That Sir Reginald Spence, Mr. H. A. W. Brent and Mr. J. B. Greaves or any two of them, be hereby empowered to take all necessary steps to effect the registration of the Society and to transfer to it all the property and assets including securities and cash belonging to the unregistered Society and for that purpose to execute on behalf of all the members of the unregistered Society all deeds, transfers and other documents which may be necessary or expedient.

The Rules and Regulations as published on pages 385-393 of vol. xxxii were passed with the following slight amendments. Rule 7 was altered to read :

> 'The capital obtained from life-membership contributions and compounded 'subscriptions shall not be used as revenue but shall be invested in Govern-'ment securities and the interest thereon only utilized as revenue. PROVIDED 'ALWAYS that if and whenever the market value of the investments shall 'equal or exceed the amount of the contributions and compounded subscrip-'tions paid by the existing life-members and the members who have com-'pounded their subscriptions then and in such case it shall not be obligatory 'to invest any further sums received by way of contributions from life-members 'or compounded subscriptions but the same may be used as revenue.'

At the present time our investments in Government paper exceed the amount paid by life-members now on the roll and we wish to be at liberty to use any surplus as members may, through the Committee, consider to be in the best interests of the Society. For instance it might be in the best interests of the Society to spend some of the surplus life-membership contributions on the equipment of the new Museum.

The other alteration was to Rule 54 and was to the effect that

> 'No payment shall be made by the Honorary Treasurer without the '*authorization* of the Honorary Secretary, or in his absence, a member of the 'Committee.'

THE SOCIETY'S ASSETS

The registration of the Society necessitated the statement of the property handed over by the old unregistered Society to the new and registered

Society and members may be interested in the valuations which were given, namely :—

Securities as on December 31, 1927 (Face value)	Rs. 90,000.	
Fixed Deposits, Bank Balances and Cash ...	,, 19,156-12-8.	
Research Collections	,, 35,000	Nominal value for Insurance.
Library Books	,, 20,000	
Publications	,, 17,500	
Journals of the Society	,, 15,000	
Furniture	,, 7,500	

THE SOCIETY'S PROPOSED 'BOOK OF BIRDS'

In 1926 we started work on the painting of the plates for the Society's popular illustrated book on the *Common Birds of the Plains of India*. We are glad to record that our artist has now finished the illustrations in colour of 200 species which completes our programme. Capt. Bates has provided us with several very interesting photographs of Bird Life and a chapter on Bird Photography. The work is therefore nearly ready for the Press and would be so now but that our staff, having so little to do !, have only completed the letterpress for notes and descriptions of about forty species. However, we hope to be able to make a definite announcement as regards price in our next issue.

THE GAME BOOKS

Writing of price reminds us that the reduction in the price to members of vols. i and ii of the *Game Birds* has caused a revival in demand and has evidently impressed on several the advantages of membership, but we must ask members, who are keen on the publication of another volume, to continue their efforts to induce other members, who have not done so, to buy and those who are not members to become so in order that they should be able to buy cheaply also.

GAME PRESERVATION

In No. 2 of this volume we gave our views on Game Preservation in India and in the editorial which appeared in No. 3 we referred to a certain amount of criticism which we had received. We give below in full a criticism by Lt.-Col. C. H. Stockley, a Member of our Advisory Committee who would like to see the sale of game or of the skins or heads of game prohibited. Col. Stockley writes under date January 10, 1928 :—

'My idea on Game Preservation is that concentration on the sale question is essential, as other questions involve dispensal of force and are open to attack : the sale question is unassailable on the crop destruction plea, as the cultivator still retains the right to kill marauding beasts. It is so-called "waste" lands which attract the poacher. It is there he makes his biggest profits and actually unites in small bands with a regular supply system. Witness the results in the Northern Circars and any accessible "waste" lands. Nowhere in India does the so-called "Zemindari" jungle hold any game but a few scattered remnants. I shot all over the country near Nowgong twenty-five years ago and got grand sport I have just been out for ten days and the country is almost bare of mammalian life. I confess to being almost fanatical on the "sale" question, as I have lately seen some of the results and heard more. The elephant question is one that ruins much of our efforts to save game. I had the figures of the Kheddah sales and outgoings, but have lost them. The damage done to crops alone is immense compared with the small results of the sales, particularly in S. India ; while the Forest Department in Kanara in 1922 temporarily offered a reward for the destruction of elephants, but had to discontinue it for want of funds. The Canara elephants were constantly being reinforced by protected elephants from Mysore and possibly even further south I have seen a herd of over eighty elephants within a couple of miles of a railway station in the Coimbatore District, while the rice fields of a Burmese village after the visit of quite a small herd in the rains, have been a really distressing sight, considering how poor the jungle folk usually are. The Kashmir game is doing well, except Markhor. These are rapidly decreasing everywhere they exist, and are vanishing from the Pir Panjal and Kaj-i-Nag. Astor is bad, Chitral worse, and the N. W. Frontier Province will soon lose the last of the straight-horned race.'

GAME PRESERVATION AND OTHER KINDRED SOCIETIES

We referred to the 'Society for the Preservation of the Fauna of the Empire' in the last editorial and stated we intended affiliating our Society to the one at home. We gave a resumé of the objects of the Society in No 1, vol. xxxii.

We now have pleasure in referring to the work done by the Nilgiri Game Association during the year ending June 30, 1927. We notice that as from October 1, 1926, Government transferred the management of the plateau fishery to the Association subject to the following conditions :—

(1) The Association shall regulate fishing in the plateau waters in accordance with the rules and regulations which the Government may prescribe from time to time.

(2) The Association will be at liberty to appropriate all receipts from licenses which they may issue for fishing in these waters, but shall be responsible for the efficient management of the fisheries and the working of these fisheries shall not be a charge on the provincial revenues except to the extent indicated in condition (4) below.

(3) In the event of mismanagement or of infringement of any of the conditions mentioned above, the Government shall be at liberty to resume the control of the fisheries without payment of any compensation ; the decision of Government as to whether there has been any mismanagement or infringement shall be final.

(4) The Government will provide for the supervision of fisheries as well as the game protection work of the Association free of charge thereby also relieving the association of the payment of Rs. 50 per mensem which it has been making to the Inspector of Fisheries the Nilgiris for the latter work.

The question of continuing the payment of rewards for the destruction of wild dogs was discussed and it was decided that the payment of the rewards should continue, although in July 1926 the Government declined to grant to the Association fines levied under Rule 6 of the Nilgiri Game Rules :—

The following were the principal alterations made in the shooting rules :—

(1) Small game shooting shall open with pigeon shooting on September 1, for the sake of uniformity.

(2) That the killing of all monkeys be prohibited.

(3) That the shooting of all Ibex except bucks possessing a well-defined saddle mark be prohibited.

(4) That only one sambhur stag be allowed on season license. On the monthly license one shall still be allowed subject to the condition that it shall not be shot on the plateau.

One of the principal changes in the fishing rules was :—

Permitting the killing of trout of 8 inches or less, such trout not to count against the limit allowed under the license.

We quote the following notes by members of the Association. Major E. G. Phythian Adams (a member of our Society) wrote :—

'The present condition of the big game in the area continues to be satisfactory, but more effective steps require to be taken to stop poaching which is on the increase. The fact that the Nilgiri Game Association has set aside a sum for reporting cases of poaching should be made known to all watchers and Forest Guards and also to the Police whose assistance is needed in checking the sale of game during the close season.

Wild dogs are still too numerous to allow the reward to be discontinued. There was a large pack at Mudumalai in May, while others were working Masinigudy and Anaikatty as usual. A small pack was reported several times on the plateau towards Mukerty.

The small Game season appears to have been an average one.

The Peermund and Bangitappal streams need restocking ; there appear to be no fish at all in the latter. There are several other good streams in the Kundahs which might be stocked with advantage against the time when the Pykara Hydro-Electric scheme will ruin the trout fishing in the Mukerty River. I do not think that any appreciable improvement in the fishing can be expected till steps are taken to reduce the present large number of otters which infest all the streams. Their food certainly consists largely of crabs, but the latter

BIRDS OF KASHMIR—AN APPEAL

For some years past I have been collecting records and notes with a view to writing a detailed avifauna of Kashmir. This work I now hope to take in hand at the end of the summer on the conclusion of a final visit to Kashmir. May I ask any of our members who have any notes and observations on Kashmir birds if they would be kind enough to contribute towards the completeness of such a book, either by sending such to the Journal for publication these under their own name in the very immediate future or by sending them to me ? I should of course be careful to acknowledge my indebtedness to any one willing to help in this manner.

By Kashmir I mean any of the territories under His Highness the Maharajah of Kashmir and Jammu following the ordinary political boundary and including therefore not only Kashmir proper and Jammu, but also Ladakh, Baltistan, Astor and Gilgit. Notes referring to any area will be most acceptable, as will be readily understood when I explain that some of the lowest and ornithologically least interesting areas are less represented in my notes than the valleys most difficult of access. For instance, there is less on record about the plains of Jammu and the Jhelum valley cart road than about Gilgit or the Nubra Valley.

Detailed lists and observations or isolated records of a single species will be equally acceptable, and in particular I should be glad of notes on the various game birds, especially those of interest to the sportsman as well as to the ornithologist.

If any one can help me with information I shall be very grateful.

CALDBEC HOUSE,
BATTLE,
SUSSEX,
April 1, 1928.

HUGH WHISTLER.

form part of the fishes' food supply and at the same time keep the number of fish down by destroying ova also those fish which the otters do take are the largest.'

Mr. J. B. Vernede, wrote :—

'All game is decreasing in the Kotagiri District and on the North, east slopes. Sambhur have decreased very markedly and as far as I am aware not a single shootable stag was seen during the season. Small game has also decreased largely, jungle fowl and hares in particular being very scarce.

I cannot ascribe any particular reasons for this decrease though poaching which is rife, may be a contributory cause, also some increase in vermin.

Writing of the year under review in general the Committee record—

(a) *Shooting—*

The year has been on the whole an average one and there is little of interest to record. In accordance with a resolution of the Committee at its meeting held on December 13, 1926 the services of all Game watchers were dispensed with from January 1927 as it was considered that they were of little if any use in checking poaching or for any other purpose.

(b) *Fishing—*

There appears to be a distinct falling off in the quality of the fishing both as regards numbers and size of fish though perhaps not in the average size of the fish in the streams.'

The following amounts were spent in destruction of Vermin—

	RS.
Wild Dogs ...	... 360
21 Otters ...	... 63
Other Vermin ...	... 74

CENTRAL PROVINCES ANGLING ASSOCIATION

We welcome the publication of the 1st Annual Report of the Central Provinces Angling Association from which we take the following extracts as regards the birth and activities of the Association.—

Early in 1927 a small number of enthusiastic anglers met together in Jubbulpore and discussed the advantages of forming an Association. It was decided to call a meeting of all those interested in angling, and, if the necessary support was forthcoming, to formally consider the question of forming an angling association.

This meeting was held at the Nurbudda Club, Jubbulpore, on March 1927, at which 13 gentlemen were present.

It was decided that the main objects of the Association should be to collect and maintain all records relating to Fishes and Fishing and generally to consider the adoption of any course or methods which might further the advancement of or improve the sport of Angling in the Central Provinces.

As regards progress the report states—

Rivers.—Owing to the fact that the Association only commenced to function practically at the close of the fishing season, it was not found possible to arrange any Association 'baiting'. This will, however, start as soon as it is practicable after the monsoon waters have sufficiently subsided. The number of 'runs' to be baited will, of course, depend on the number of 'baiting' subscribers.

Tanks.—It is to be regretted that, up to the present, it has not been possible to make any satisfactory arrangement with the irrigation authorities for the preferential recognition of the Association in respect of the tanks under their charge.

With regard to identification. It is interesting to note that all the larger carp caught in the water-works area during the period for which this water was open to the Association have been proved to be *Barbus hexastichus* (Day's *Fishes of India*, p. 565, plate cxxxvi, fig. 4), and not '*Barbus tor*' (the ordinary Mahseer). Day records these fish as growing up to 3 feet in length.

The only other fish that have so far been formally submitted for identification proved to be two *Macrones seenghala* (one of the Tengara or cat-fish group), which were caught with a small spoon in a pool in the R. Gaur, upstream of the village of Kosamghat lying about a mile north of Jubbulpore-Mandla road between the seventh and eighth mile-stones. The two specimens recorded measured 14½ and 13½ inches respectively.

OBITUARY

JOHN WILLIAM YERBURY

We regret to record the death on November 10 last as the result of being knocked down by a motor car, of Lieut.-Col. J. W. Yerbury, late R.A. Col. Yerbury who was aged eighty at the time of his death, was born on March 30, 1847, at Serampore in Bengal, and was the son of Lieut.-Col. John William Yerbury, of the 3rd King's Own Light Dragoons and afterwards of Belcombe, Bradford-on-Avon. He obtained his commission in the Royal Artillery in 1868 and up to his retirement in 1892, served in various parts of the world. He was for many years stationed at Aden, and from his papers on the Birds of this settlement (which appeared in the *Ibis* for 1886 and the Society's Journal for 1897) he was well-known to ornithologists.

Col. Yerbury was one of the earliest members of the Bombay Natural History Society, being on the rolls in 1886 when the Society issued its first Journal. Besides ornithology, he was keenly interested in Mammals, Reptiles, Lepidoptera and Diptera, of all of which he made considerable collections, especially of the last named which he eventually presented to the British Museum. He also collected shells at Aden, several of which were described by the late E. A. Smith (*Proc. Zool. Soc. London*, June 16, 1891) as new species and named after him. After his retirement his chief interest appears to have been confined to Diptera on which group of insects he wrote several valuable papers.

His most important contributions to the Journal of this Society are as follows :—

'The Butterflies of Aden and Neighbourhood, with Some Notes on Their Habits, Food Plants, etc.,' vol. vii, p. 207.

'A List of the Birds of Aden,' vol. xi, p. 75.

His appeal for assistance in collecting Gad Flies, Bot Flies and Warble Flies (vol. xiii, p. 683) contains some very useful instructions for collecting these insects.

Officers quartered at, and residents residing in Aden have cause to be indebted to the late Col. Yerbury for leaving behind for their use with the Political Resident at Aden, a set of valuable pamphlets on the Flora and Fauna of the settlement 'as complete as I have been able to make it.'

EUGEN M. VAN INGEN

The death occurred at Mysore on February 27 of Eugen M. Van Ingen the well known sportsman and taxidermist, after a severe operation. Mr. Van Ingen joined the Bombay Natural History Society in 1913 and was known among a very wide circle of friends, as the very best of good fellows. Mr. Van Ingen's fame as an artist in taxidermy was only equalled by his keenness and proficiency as a shikari and fisherman. Some of the biggest known records in jungle and stream were annexed by him and his advice and assistance were freely sought in big game expeditions organized in the State on the occasion of the visit of distinguished guests, notably the Prince of Wales, the Earl of Reading and H. E. Lord Irwin. His death, which creates a great gap in the personnel of Indian shikar, will be deeply deplored by hosts of sportsmen throughout the country.

MISCELLANEOUS NOTES

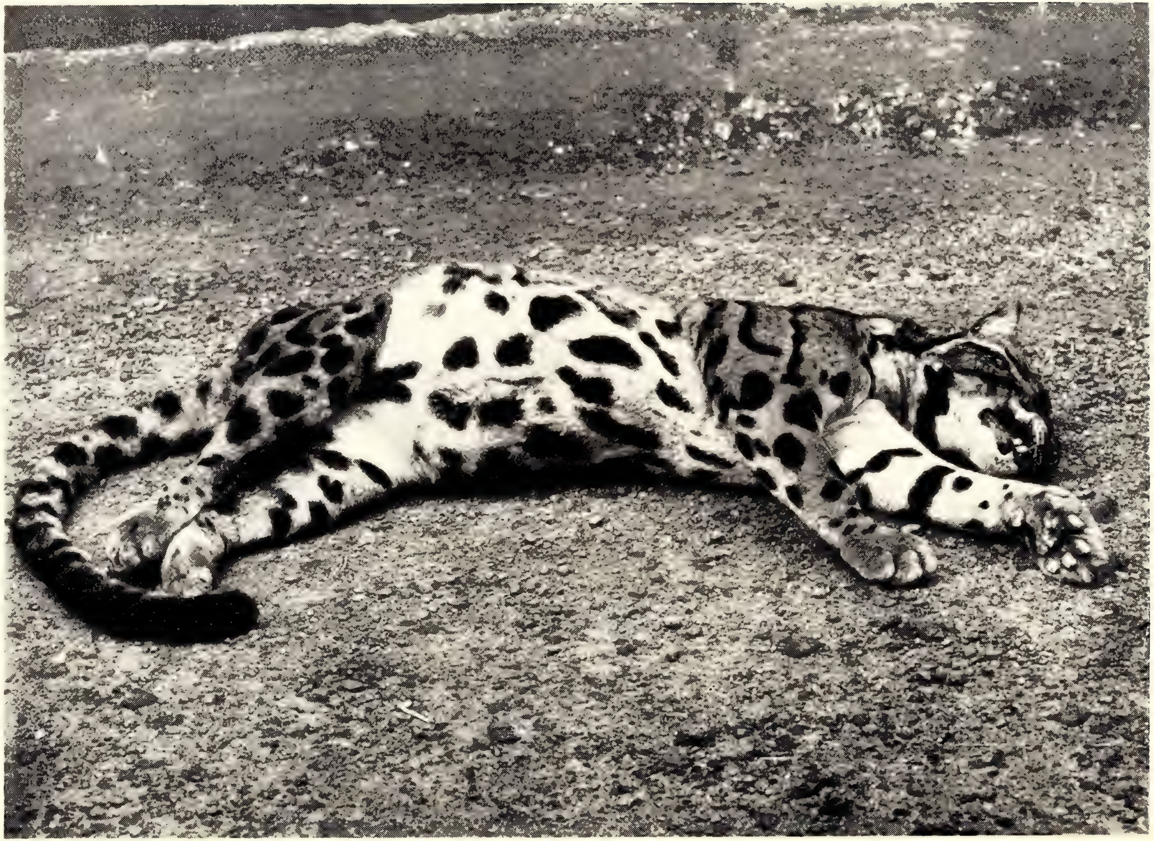
I.—THE TRUTH ABOUT 'A UNIQUE LION PHOTOGRAPH'

We are glad to notice that the photograph of a young Lion attacking a Zebra, published on page 583 of this Volume has aroused such considerable interest amongst our readers.

Writing on the 20th of March, Mr. F. W. Champion, the well-known wild animal photographer and author of *With a Camera in Tigerland*, puts forward a number of well-considered and cogent reasons for his belief that the photograph is one of those ingenious fakes which are unfortunately much too common with Natural History subjects. Quite naturally, however, he could not be altogether certain that it *was* a 'triumph of the faker's art', and admitted that if genuine, it must in his opinion be 'by far the finest natural history photograph ever taken by anyone or likely to be taken.'

Sometime back we had written to Messrs. Hutchinson & Co., the publishers of *Animals of all Countries*, for information regarding the same photograph reproduced in their book, and referred to in the note which accompanied our plate. To this we recently heard from Mr. Wm. Martin-Hurst, Managing Editor of the Exclusive News Agency, London, ('E.N.A.') who kindly wrote to say that he could give us no particulars beyond the fact that their original photograph was a very old copy, having been in their possession for at least 25 years; that as far as he knew it came originally from an American source and was said to have been taken by a well-known American Big Game Hunter; and that various people more or less qualified to speak had cast considerable doubt on the authenticity of the picture.

Still more interesting are the cuttings from *The Camera* for April and June 1927 received by the last mail through the kindness of one of our members, Mr. A. J. Page, which help conclusively to run the photograph to earth. The April (1927) number of *The Camera* in noticing a monthly Magazine of photography issued by the Soviet from Moscow entitled 'Sovietskoe Foto', reproduced from its pages the same Lion-Zebra photo with the following graphic and soul-stirring account: 'One of the pictures which we endeavour to reproduce is without exception the most dramatic and tragic nature picture that we have yet seen. It is said to have been taken by a hunter on the plains (or steppes) of Africa. It shows the triumphal ride of a lioness on the back of a Zebra, terror depicted on the unfortunate animal's features as in vain he flies to escape from the fate that awaits him. It reminds one in its wild way of the triumphal march of an emperor through the streets of Rome celebrating his victory. Nothing was spared to display the barbaric glory of the victor, even to the march of his conquered victim, barefooted and in chains. Here is the Queen of the jungle, emblem of ferocity and cruelty, and it requires no imagination to realize that in an instant



The Clouded Leopard (*Felis nebulosa*). (See Miscellaneous Note No. II) the Zebra must collapse and that the Lioness's fangs will be in its throat.'

The publication of the Soviet photograph in *The Camera* promptly elicited the following letter to the editor from a good lady in Bakewell, Derbyshire, whose name is not given as the gentleman she refers to (whom we by no means envy !) has quite wisely preferred to remain silent in spite of being addressed on the subject·

'Dear Sir—It may be of interest to you to know that the actual photographer of the incident you reproduce of the Lioness and Zebra, resides here in Bakewell. Having had in my possession a copy of this, I was more than astonished to find it on the front of your magazine when in a Sheffield photo shop last month. I was in conversation with the gentleman only yesterday and he assures me that the incident did really happen as depicted, and that he was a member of the hunting party. It certainly did not happen recently, as he has left South Africa since 1916. How it has got to Soviet Russia has yet to be explained.'

While these amusing and amazing claims and counterclaims were in progress, the matter seems to have been brought to the notice of the 'iconoclastic' Dr. G. Arnold, the Curator and Zoologist of the Natural History Museum, Bulawayo, whose conclusive letter on the subject expresses our sentiments admirably. Dr. Arnold writes under date 29th April 1927 :

'Dear Sir—It is quite correct that the photograph on the cover of *The Camera* is taken from part of a group in this Museum. Some years ago a photo was taken of this group, and, with a faked background added, was published in the United States with the information that it was a snapshot taken by an intrepid hunter. 'Liar' would perhaps have been a more correct description of the intrepid gentleman. The photo on the cover is not new to me, as it was published elsewhere some years ago, and broughr to my notice.'

Our thanks are due to those members who have communicated to us their views on the photograph, and helped towards the final elucidation of the mystery.

EDITORS.

II.—A CLOUDED LEOPARD (*FELIS NEBULOSA*) ATTACKING MAN

(*With a plate*)

I enclose a photograph of an animal which was brought in by a Karen boy who stated that while cutting wood near his village he saw the animal approaching him and when it saw him it crouched and approached him cautiously 'pushing bundles of branches and leaves in front of it.' It sprang at the boy who split its skull with a *dah* (knife). I find on inquiry that this is generally believed to be the usual method this animal adopts when approaching its prey whether as a means of concealment or to puzzle its prey I am unable to say. Perhaps you could enlighten me on this point.

The animal is a species I have never seen or heard of before; it is known locally as ' In Cha.'

This particular individual is known to have taken several head of cattle in the vicinity.

TAVOY, BURMA, A. BROWNLOW,
December 10, 1927. *Indian Police.*

[The identity of the animal in Mr. Brownlow's note and photograph as the Clouded Leopard (*Felis nebulosa*) is confirmed by the skin sent us for examination. This beautiful and somewhat rare cat inhabits the hilly portions of Burma, Siam, Malay Peninsula, Sumatra, Java and Borneo and also occurs in Assam, Sikkim, Bhutan and the Nepal Himalayas. It attains a length of from 6 to 6½ feet of which 2½ to 3 feet is taken up by the long and thickly furred tail.

Our knowledge of the habits of this animal is very scanty and Mr. Brownlow's note forms an interesting addition. It is believed principally to be an arboreal species feeding on small mammals and birds which it captures among the branches. EDS.]

III.—NOOSING TIGERS

Among the coolies on these hills there has been a custom (which I have strenuously tried to stop) of setting traps and wire nooses for the catching of Sambur, Barking Deer and Pig.

I was informed one day last month that a tiger was heard ' Making plenty big noise ' at a place about four miles from my bungalow. On arriving at the scene I found him to be about 98 per cent dead and proceeded to put him out of his misery.

On examination I found that the tiger had been caught around the neck by a wire noose, presumably placed for the unwary sambur. The wire had been placed across a well-trodden sambur track.

The wire in question had a total length of 10 ft. 7 in. was 5 ply of approximately 20 gauge. The far end was affixed to small sapling, at a height of about 3 ft. from the ground.

The beast was a full grown male, in healthy condition, measuring 9 ft. 8 in.— ' fair do's ' —between pegs.

Last year a similar case occurred on a neighbouring estate, the wire in this instance was ordinary telegraph wire. The beast, I am told, measured, 9 ft. 7 in.

Yet another case occurred last year in which a tigress was noosed, of the particulars of which I am afraid I am ignorant.

How is it that a noose, presumably placed for snaring sambur, will catch a tiger which usually walks, and even stalks with his head down?

PALAGAPANDY,
NELLIAMPATHIES, H. A. BOAS.
November 22, 1927.

IV.—REPLY TO MR. PHILLIPS' NOTE ON P. 371, VOL. XXXII *RE*-COLOUR OF THE LONG-ARMED SHEATH-TAILED BAT (*TAPHOZOUS LONGIMANUS*)

I am quite in agreement with Mr. Phillips that the young of *T. longimanus* are coloured like the females (and *not* like the males) as is the general rule with all juvenile animals.

It is very apparent that he has confused the statement of Blanford with mine, as will be clearly seen from the paras which I reproduce below :—

Mr. Phillips writes, ' I do not, however, agree with the suggestion that the young of this bat are pale fulvescent and become gradually black with age. I am convinced from my experience (*so am I.*, C. Mc C.) with species in Ceylon, that the opposite is in reality the truth, that is to say, that the young are darker in the first coat and become gradually lighter and more brightly coloured with age, the adult male becoming light reddish (almost cinnamon) brown eventually.'

The following is an extract from *my* note in the Journal vol. xxxi p. 1030 :—

' All the three males were much lighter in colour than the females, being a yellowish-brown : the females on the other hand were dark blackish-brown, almost black. Blanford, in the *Fauna of British India*, mentions that Blyth observed the young individuals to be pale fulvescent and that they become gradually darker with age. Whether these paler ones were males or females he does not say, for they might have all been males. One male taken by me the day before was even paler than those secured in the Museum, being a very pale fulvescent tint.

On looking through the material in the Society's collection I found this difference to be the general rule, only a few being like the females which are probably young specimens. One at least is very young and coloured like the female. In almost all cases I could pick out the males from the females by the difference of colour alone.'

With regard to the question, ' Whether these paler ones . . . . for they might have all been males ?' I doubted Blyth's statement regarding the age of the bats. I did not mean to suggest for a moment that the young were coloured like the males ! It is quite clear from my statements in the second para ' . . . only a few being like the females which are probably young specimens,' and ' one at least is very young and is coloured like the female,' that I was of Mr. Phillips' opinion that the young were coloured like the females and not like the males.

BOMBAY, C. McCANN.
January 10, 1928.

V.—HABITS OF THE PORCUPINE

Mr. C. McCann's note on the Habits of the Porcupine in vol. xxxii, No. 1, has somewhat surprised me. Porcupine exist in large numbers on these hills (the Billigirirangans) and it is very noticeable that not only their little paths, on the hill-sides, but also paths formed by deer and other game are strewn with their droppings but I have never noticed cone-shaped accumulations of their excreta. The little Four-horned Antelope, which has only two horns in these parts, and is known as the *Pokey*, is addicted to this habit and the above is a good description of the little mounds of excreta formed by them: but similar formations in the case of porcupines are not seen here.

HONNAMETTI ESTATE,
ATTIKAN P. O.
via Mysore,
December 11, 1927.

RALPH C. MORRIS.

VI.—AN ELEPHANT WITH EXTRAORDINARY 'GLANDS'

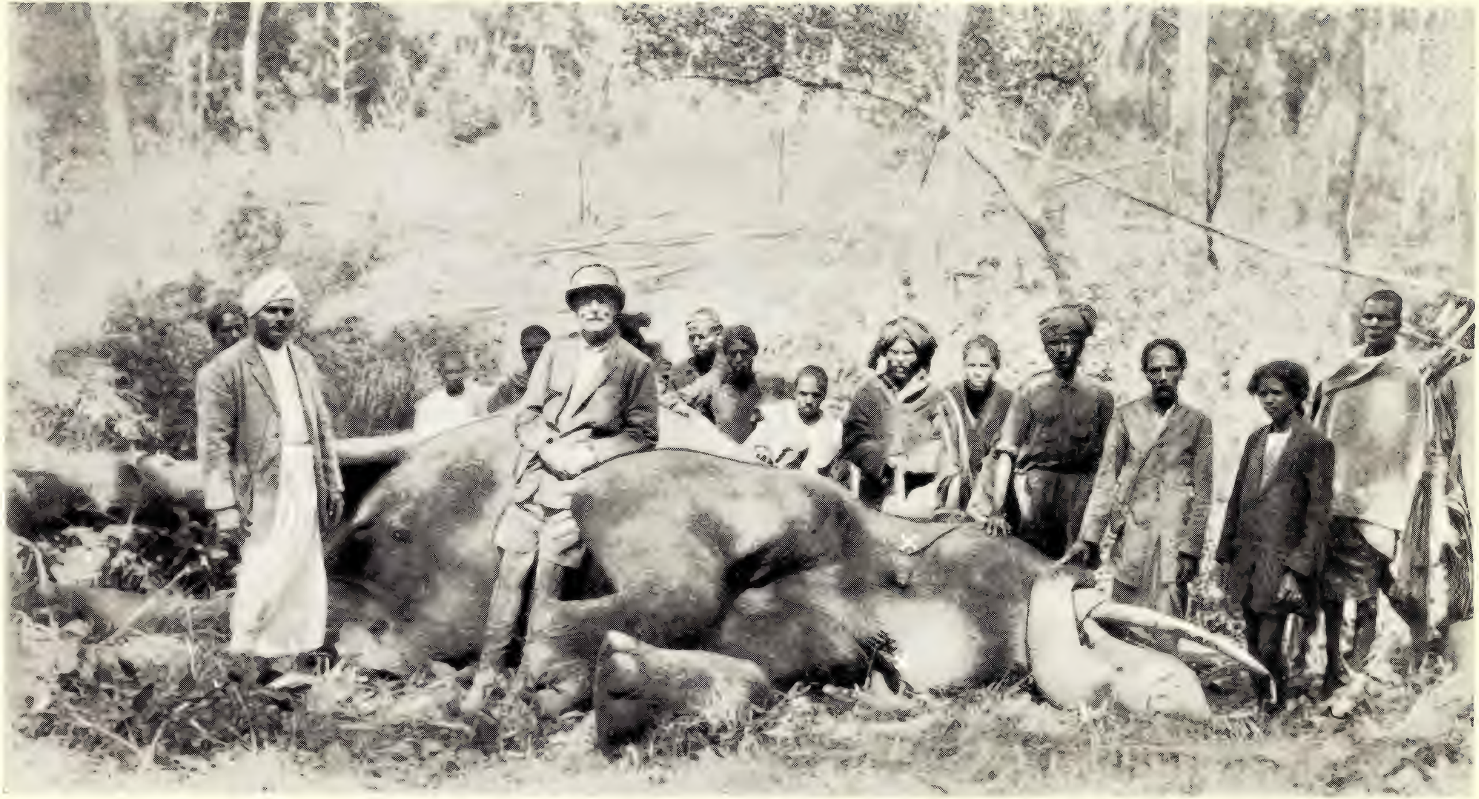
(*With a plate.*)

In answer to your letter of December 29, regarding the Bellagalla Rogue Elephant which I shot and sent you the snap of, which had two extraordinary glands on the neck, which I thought might be of interest to you, I will briefly give you some particulars which may be of further interest.

This elephant used to frequent the forests between Coimbatore District and Mysore State, adjoining the Billigirirangan Hills. I shot it in the valley about half-way between Attikan and Kollegal.

During the past two years or more, it had become a great menace to the people living in the wilds round about and it took to destroying their crops and no one dared to go anywhere near to drive it away without being chased by it. It made short work of a few unfortunates whom it got hold of and from all accounts it simply trampled them out flat. It was proscribed a rogue about two years back and though many set out after it, they did not have the fortune to meet it. Mr. Ralph Morris of Attikan who I believe is well known to you, promised to send me a wire if any reliable khubber reached him about rogue elephants, of which there were many, making their appearance off and on round about Attikan, and as luck would have it he wired to me on October 24, and I managed to get to him on October 26. We got into touch with the rogue on 29th and after much tracking we came upon him in an opening in the thick jungle, quite suddenly. I feel sure he had his eye on us. He stood quite still about 40 yards off giving us a broadside shot. Morris let me have the shot and I got in a well placed shot between the eye and ear which stunned him and Morris followed up with another shot immediately after and he swung round falling on his side on the slope of the hill as the picture shows and I placed another good shot at the base of the skull which ended his career. It was all over in a minute or so. On going up to him I noticed the two glands (I call them glands but may be I am wrong).

The one you see on the upper side (right) was about 3 to 4 inches long, whereas the one on the underside was quite, 9 inches long. They were both very slimy in appearance and to feel. They were



Mr. A. S. Laurie's Tusker showing the peculiar gland-like growths on neck (X).
Upper 4 inches and lower about 9 inches in length.

coated with a whitish fluid (slime) and seemed to be merely two bags or envelopes, which you could distend, being very elastic. They were black in colour. The lower one looks white due to the sun shining down on it and probably the reflection from the slime causes it to look white in the photo.

The light was very difficult being about 8.45 a.m. and the sun was just peeping over the hill through the thick growth. The photo I send (reproduced herewith) was the best of three snapshots.

By the way I know Mr. Ralph Morris cut off the lower gland with the idea of sending it to you. I do not know if he actually did so for I had to leave hurriedly.

The people of the forests who accompanied us told us that they had never seen any elephant with this extraordinary formation under the neck and I have made enquiries of others who have had a lot to do with elephants and they say the same. It will be interesting to learn if possible what function they could possibly perform.

COIMBATORE, A. S. LAURIE.
S. INDIA,
January 4, 1928.

[Regarding, the above tusker and the extraordinary 'glands' Mr. Ralph C. Morris writes us as follows :—

'I was with Mr. Laurie at the time he shot the elephant and we were both amazed to see, when we went up to the fallen tusker, that it carried a most extraordinary pair of appendages on its neck, one on either side behind the lower jaw-bone as can be clearly seen from the photograph. The appendages were in the shape of sausages, the upper one being about 5 inches long, and the lower a good 9 or 10 inches. To the touch they were tender and appeared to be covered with a skin of unusual thinness, the skin being of a raw appearance, mottled grey-pink in colour and moist. Apart from the fact that the elephant was clearly in "Musth", there being a flow from the "Musth" gland orifices, I cannot think what was the cause of these extraordinary growths, nor can I assign any reason for them. I referred the question to Mr. Saunders, Principal of the Veterinary College in Madras, but Mr. Saunders could advance no theory on the matter. He had seen nothing of the kind before, and although I have been in at the death of eleven or twelve proscribed elephants I have never seen a similar case before, nor have I seen growths of this kind mentioned in any work on elephants. I had the larger of the two appendages cut off and gave instructions for it to be pickled preparatory to sending it to the Madras Veterinary College for examination. Unfortunately my instructions were misunderstood by my skinner who, instead of preserving the whole appendage, skinned it, threw away the inside, and pickled the skin! Can you ascribe any possible reason for these growths, and have you heard of a similar case before?'

Mr. A. J. W. Milroy, I.F.S., of Assam, who has had considerable experience of elephants, both tame and wild, writes to say that he has never come across any glands of this sort.

Mr. N. L. Bor, I.F.S., of Goalpara District, Assam, another authority on elephants writes in this connection as follows :—

'As far as my experience goes I have never seen growths of the type mentioned by your correspondent. Tumours of a fatty or serous nature are not uncommon and I have seen them both in tame and wild elephants. These tumours which are soft and elastic are not infrequently found on the folds of the skin on the neck. Those which are serous in type contain a fluid which is rather slimy and of a barley-water colour.

It seems to me that the growths in question, I do not think they can be glands, are of a similar nature which may have possibly become chronic or malignant.'

It is extremely regrettable that owing to a misunderstanding the contents of the ' glands ' should have been lost. It would be interesting to hear what Zoologists have to say about these growths or appendages. EDS.]

VII.—ON ' NATURAL DEATHS ' IN WILD ELEPHANTS

With regard to Mr. F. W. Champion's interesting article on ' Wild Elephants in the United Provinces ' in vol. xxxii, No. 1, in which he quotes instances of elephants having been found dead, the case of the elephant found dead in the Lansdowne Division certainly seems to be one of death from old age. Is there not just a possibility however that it had been poisoned by villagers ? Mr. Champion mentions that the graziers had known the elephant for a year, and that it was too old and weak to run away *with the other wild elephants when driven from the crops of the neighbouring villagers.* This may be so : but I have known of elephants frequently refusing to be driven off from villagers' crops, remaining in cover close to the fields when the rest of the herd had retreated back into the jungles. I once came upon the decomposed carcases of three cow elephants at the foot of these hills. The local forest subordinate informed me that he thought the elephants had probably died of anthrax—though he could advance no evidence in support of his theory : no other elephants had been reported sick or died : nor did I hear of any other deaths. The elephants were lying dead within a few yards of each other. I do not think that the anthrax theory was possible, nor do I consider it at all likely that the elephants had died of natural causes. I was assured later by my trackers, that the ryots in the fields these elephants had been in the habit of visiting and causing considerable damage to, had put out a number of poisoned pumpkins, etc., which these elephants had eaten. Here there was the possible cause of their death. Mr. Champion speaks of the elephant having been moved from its first position. This is quite possible. I have seen a wild elephant trying to move a tusker (a proscribed rogue) I had shot : and in the case of a herd tusker shot by the late Mr. R. H. Morris the carcass was actually shifted a few yards by other elephants of the herd which returned to the spot later. A tusker shot by Mr. A. L. Laurie of Coimbatore in November 1927, when I was with him, on a slope above a stream was moved a few yards down to the edge of the stream by elephants in a herd which visited the place a day or two later. This elephant was clearly in 'Musth', there being a discharge from the 'Musth' gland orifice between the eye and the ear on either side of the head. It is remarkable how quickly the skeleton of an elephant will disappear, and Mr. Champion in no way exaggerates when he says that 'a single season may easily remove the entire body and much of the skeleton of an animal even as large as an elephant.' A couple of years is sufficient to remove all traces of a dead elephant—except perhaps the skull which may be found hidden away in long grass and dense undergrowth for a year or two longer. Protection has undoubtedly contributed to the increase of elephants in South India. Probably the Kheddas held by the Mysore Government do more than anything else to keep their numbers down in these parts, but even then I consider that elephants are rapidly increasing. When I was in camp last March there were at one time four separate and distinct herds of elephants near our camp and three or four solitaries besides.

I have just received Mr. Champion's book *With a Camera in Tiger Land.* The photos shown of Tiger, Panther, Elephant, Deer, etc., in their natural state are wonderful and the reading enthralling. Mr. Champion writes as only a keen naturalist and lover of jungle and its denizens could write. The photographs are superb, and one can imagine the trouble and painstaking care involved in the achieving of such thrilling results.

HONNAMETTI ESTATE,
ATTIKAN P.O.,
Via Mysore,
December 11, 1927.

RALPH C. MORRIS.

VIII.—CLICKING NOISE MADE BY MUNTJAC

In your issue of August 1, 1927 'Miscellaneous Notes' I have read a note with the above title by Mr. Randolph C. Morris.

I am surprised to learn that Col. Burton has never heard the Muntjac (the Khákar or Barking Deer of Northern India) emit this clicking noise. I spent many years in the forests of the United Provinces, between 1889 and 1918, and very frequently heard the noise described, especially when the Khákar was disturbed at close quarters.

The noise is, as stated by Mr. Morris, only produced as the animal bounds off. I believe it to be restricted to the male only but I cannot be absolutely certain of this.

The noise is a rapidly repeated cluck–cluck–cluck. . . . Generally only six to eight repetitions, and I have always believed to be produced in some way by impact of the animals' teeth. It is far too rapid (about three to the second) to be produced by the feet and as a matter of fact a very similar sound may be produced by striking two pieces of bone together.

B. B. OSMASTON,
Indian Forest Service (Retd.)

IX.—CROWS AND KOELS

M. Jouguet's letter in the number of the Journal published on October 20 last reminds me of an occurrence which came to my notice some three months ago, which may be worthy of note.

Crows having become an insufferable nuisance round the bungalow, I had taken to shooting them, in the forlorn hope of driving them away. As is the way with crows, they had become sufficiently knowing to keep just out of range, and we had reached the stage when, by careful stalking, I occasionally got one which was either too daring or too slow.

One evening, shortly before sundown, this game was in progress, all the birds being between me and the sun, when suddenly there was a loud 'caa' from the far side of a *Derris robusta* tree near by. Looking up, I could just make out a black body through the feathery foliage, and shot it.

On picking up the bird, I was astonished to find that it was a female koel (*Eudynamis scolopaceus malayana* ?). It had appeared to be black from being against the sun, and its 'caa' was such a perfect imitation of the real thing that, although I could not make out the shape of the bird, I had had no doubt that it was a crow.

Has this occurrence been recorded before ? If so, is the object of it known ? Had it been a different time of year one might have supposed that the koel was endeavouring to mix with the crowd to accompany the crows to the roosting place. There was no sign of a male koel, though I watched until the birds began to clear away. Moreover, it is the only time in six years of residence in the bungalow that I have known of a koel anywhere near the compound.

TOCKLAI EXPERIMENTAL STATION,
CINNAMARA P. O. & T. O.
ASSAM,
December 19, 1927.

E. A. ANDREWS,
Entomologist,
Indian Tea Association.

X.—THE RUFOUS-BREASTED BLUE FLYCATCHER (*CYORNIS HYPERYTHRA*) AT HIGH LEVELS

While examining recently the series of *Cyornis hyperythra* (Blyth) belonging to the Bombay Natural History Society's Museum I found two specimens differing markedly from the rest which were in agreement with authors' descriptions : Oates, Baker, etc.

The two skins are generally paler greyer-blue above ; much less rufous below and perhaps have more white on the tail than in examples representing the typical race which has Darjiling for type locality. They are also paler and greyer than the south-eastern forms.

One of the birds was taken at 6,000 ft. on Mt. Victoria, Burma, and the other at Dakuri, 10,200 ft., on the Pindar R., north of Almora in Kumaon.

These localities are practically at the extremities of the range of *C. h. hyperythra* so it seems out of the question to regard them as representatives of a distinct race unless that should be a high-level form.

This note is written to suggest that those possessing other high-level specimens should compare them with more topotypical examples.

SINGAPORE, C. BODEN KLOSS.
December 20, 1927.

XI.—THE NIDIFICATION OF THE SIND HILL WARBLER (*SUYA CRINIGERA STRIATULA*).

In the *Fauna of British India*, Birds, Revised Edition, vol. ii, p. 520, the nidification of the Sind Hill Warbler (*Suya crinigera striatula*) is shown as not recorded, and the following note may therefore be of interest.

During the last week of July of this year I found the bird common on the hill of Sakesar, some thirty miles east of the Indus and at the extreme west of the Punjab Salt Range, of which it forms the highest point (4,992 feet).

Its favourite haunts appeared to be steep slopes covered with long grass and well supplied with bushes of various kinds. Nesting operations were in progress and several nests were found, mostly in course of construction.

In one nest a bird was sitting on two eggs on July 24, and again on 28th, when the eggs were taken and the male parent secured. The eggs, which were slightly incubated, have a ground colour of very pale pink and are marked with pale reddish blotches scattered over the whole surface and most numerous at the broader end, where they form an ill-defined ring. The nest was situated, barely twelve inches from the ground, in a ' Sanatha ' (*Dodonœa viscosa*) bush, through which some tufts of grass were growing. It was an oval-domed structure, made of strips of grass, and the lower portion was matted with seed-down. The inner lining was of fine grass, and the entrance faced north.

Another nest, similarly built and situated, contained three half-fledged young on July 28.

A small series of the birds was collected and sent to Mr. H. Whistler who kindly identified them.

I have not met with this Warbler in any other part of the Salt Range.

SARGODA, H. W. WAITE, F.Z.S., M.B.O.U.,
PUNJAB, *Indian Police.*
October 15, 1927.

XII.—ON THE UNUSUAL FOOD-HABITS OF HORNBILLS

Apropos the subject of the unusual food-habit of *Dichoceros bicornis*, Linn., as recorded by Mr. W. S. Wood in *J.B.N.H.S.* (vol. xxxvii, page 374) it is worthwhile to cite an instance of the piscivorous habit of *Lophoceros birostris* (Scop.) which came under my personal observation. It was in 1926 when at Hazaribagh I bagged alive a specimen, very slightly injured by my gun-shots. Anxious as I was to keep it in captivity, I was confronted with a vexed problem as to its diet. Knowing it to be a frugivorous bird I tried all sorts of fruits and berries, which I found it, to my amazement, to avoid studiously. It was literally starving itself for a couple of days and would touch nothing except water. When I tried to force a piece of ripe banana down its throat it would simply disgorge the whole thing out. At last when some small fish were presented before it, it readily paid attention to the fry, and after throwing these up one by one in the air, it would catch them in its bill and gulp down. The fact of this bird having any greed for fish has never been recorded anywhere. In this case also the question arises whether it is a practice commonly indulged in by these birds in their wild state or merely a case of individual idiosyncrasy noticeable in captivity. The fish-eating habit has only been observed in the case of *Anthracoceros m. malabaricus* (Gmelin). The other members of the *Bucerotidæ* appear to be largely frugivorous, although a varied menu consisting of smaller reptiles and rodents, snails and various insects is also more or less indulged in. R.B. Sanyal, a former Superintendent of the Calcutta Zoo, prescribed for the captive Hornbills a carnivorous dietary, within which small birds were included (*vide* his Handbook of the management of animals in captivity in Lower Bengal). It is, therefore, easy to realize that with a hungry Hornbill nothing goes amiss provided its size falls within manageable limits. I have even seen *Lophoceros birostris* (Scop.) devouring the petals of *Bauhinia* flowers, which appear to form a major part of the bird's diet in places where there is a comparative dearth of fruit trees and berries. The omnivorous habits of the Hornbills are no doubt responsible for their occasional outbursts of criminality (which finds a full play in captivity when weaker companions are housed with them) but how far the predatory instinct is let loose so as to play its part in Nature's economy is a point which cannot be answered until all the data are available as to the food habits of each species.

CALCUTTA.

SATYA CHURN LAW,
M.A., B.L., PH.D., F.Z.S., M.B.O.U.

XIII.—THE BLACK-CAPPED KINGFISHER (*HALCYON PILEATA*) IN THE DARBHANGA DISTRICT, BIHAR

I have on several occasions recorded the occurrence of this bird in Bihar in these pages, most of them being got in February. It is rare but not as rare as I at first took it to be. I now record another which I shot in September.

On the afternoon of September 17, 1922, while out in boat fishing with my brother on the Bhagmati River near Bunhar factory we got within five yards of one of these birds. The river is an open one running through cultivation and the Kingfisher was on a bush overhanging the water. It took absolutely no notice of the many small fish which came to the surface nor of us in the boat till we got within that distance of it; even then it only flew across to the other side of the river. We disturbed it on several occasions and what I noticed most was that it flew off silently on each occasion quite unlike an Indian White-breasted Kingfisher (*Halcyon smyrnensis fusca*) which went off uttering its loud, harsh cry. We came across it again on the 19th, this time seated on the bank and finally I shot it on the 20th. It was silent on all three days so I have never heard its cry. It is easily recognized on the wing by the buffy lower plumage, the upper plumage looks black except when the sun shines on it, then it glistens. The contents of the stomach consisted of a small crab; other specimens examined had fed on fish and beetles. The local *Mirshikars* consider it only an albino of the white breasted species and call it *Ablak Tanki.*

DARJILING,
September 28, 1927. CHAS. M. INGLIS, F.Z.S., F.E.S., M.B.O.U.

XIV.—A QUAIL'S QUEER RETREAT

(Reprinted from the Sunday Times, Johannesburg, Transvaal, November 13, 1927.)

A singular case is reported from Somerset East, C. P. A shearer working at Hope Vale, a farm in the district, was busy on a heavy woolled ram of Messrs. W. G. Jordaan and Sons, when he felt a hard lump in the wool on the belly.

On opening up the fleece he found a live, fully-grown quail!

It is supposed that the bird had crept for shelter into the long wool while the ram was lying down, and had remained there when it was driven to the shearing shed. It is stated that there were several witnesses of the find.

Has anything like this been found elsewhere?

XV.—OCCURRENCE OF THE SHELDRAKE (*TADORNA TADORNA*) IN THE DARBHANGA DISTRICT, BIHAR

There have been notes in late Journals of the occurrence of this duck in various parts of Bihar, so it may perhaps be interesting to gather together data of those got by me; some of these have already been noted by me in this Journal, my first record being in vol. xv, p. 338 of 1903. During that year I got one from Mr. Edgell and another was snared not far from Baghownie. In 1905 I got four specimens, two drakes from the Benoa *chaur* on May 1, and June 5, and two ducks, one on November 6, near Baghownie and the other on the 30th of that month from the Maiser *chaur*. I don't appear to have got any more till 1915 when one was brought in alive by a *Mirshikar* on July 28. It was in good condition and didn't appear to have been wounded at any time. During the following year I got a fine drake near Baghownie on May 12, with a well developed knob on its bill. It was on a small patch of mud and water, more mud than water. The last record I have is of a duck got at the Benoa *chaur* on June 24, 1923 another late date for it to be found. After that I left the district but have no doubt that had I remained there I would have been able to add to these records. Besides these nine specimens I have also heard of one or two others being shot.

DARJILING,
September 28, 1927. CHAS. M. INGLIS, F.Z.S., F.E.S., M.B.O.U.

XVI.—OCCURRENCE OF THE SHELDRAKE (*TADORNA TADORNA*) IN THE UNITED PROVINCES.

On December 25, 1927 at Saman Jal, Mainpuri District, United Provinces, there were shot two specimens of the Sheldrake (*Tadorna tadorna*).

ROORKEE,
January 4, 1928. E. E. L. SEARIGHT, *Capt.*,
R.E.

XVII.—RECOVERY FROM THE BITE OF A PHOORSA (*ECHIS CARINATA*.)

No. 4179383. Fslr. Brannar, 1st Royal Welch Fusiliers, had been employed on fatigue, with other men, in knocking down a wall. The wall had been knocked down and the men were carrying away the stones. Brannar lifted up a large stone and was bitten by the snake, which was underneath. This was at 5.10 p.m. on October 4, 1927. He reached hospital about 5.30. There were two well-defined punctures on the dorsum of the terminal phalanx of the right middle finger, which were slightly oozing. The orderly assistant surgeon incised them and rubbed in permanganate crystals. He was seen by the orderly officer about twenty minutes later and was given 40 c. c. of antivenin serum, subcutaneously, in the flank. He did not show the faintest trace of constitutional disturbance. He showed us a small gland in his right axilla, and said that he felt a slight tingling running up from the finger to the gland, and added that the tingling was not painful. He was detained for 36 hours, and then discharged to ' attend '. I saw him, this morning. He assured me that he had not felt the slightest ill-effects, at any time, and he is an intelligent man. There was slight thickening over the incisions, and one was oozing a trace of serum. The finger was not painful.

The stone had already been disturbed with a crow-bar, before Brannar picked it up. It seems to me that the absence of all signs of poisoning may be due to the snake having struck at the crow-bar and emptied its poison sacs, before Brannar lifted the stone.

BRITISH MILITARY HOSPITAL,
NASIRABAD,
October 9, 1927.

A. A. MEADEN,
Lt.-Col., R.A.M.C.

[The snake that bit Fslr. Brannar has since been sent to us and identified as the Phoorsa (*Echis carinata*). We append a note on the subject of Indian snake venoms by Lt.-Col. F. P. Mackie, I.M.S., Director of the Haffkine Institute, Bombay, which is of great interest. He writes :—

'The mortality from snake bite in India is due in the large majority of cases to one of four species. The cobra and the krait which are known as colubrine snakes, and the Russell's viper and the *Echis* (or phoorsa) which are viperine.

The poison of colubrine snakes affects chiefly the nervous system and produces paralysis of various muscles, staggering gait or incoordination of speech followed by respiratory paralysis, convulsions and death by respiratory failure. The symptoms of viperine poison are severe and persistent pain at the position of the bite and oozing of blood from the punctures. Death may take place from paralysis of the heart or from clotting of blood in the vessels if the dose is large or is injected into a vein but if life is prolonged hæmorrhages take place from the mouth, nose or intestines or in various part of the body. Mortification and gangrene occur at the site of the fang marks and the finger or hand may be lost in this way even after the general symptoms have passed off.

The minimum fatal dose of cobra venom is about 15 milligrams (about 1/5th grain) and the snake gives from 5–10 lethal doses at one bite. The krait can deliver five times the lethal dose and the Russell's viper and Echis about twice the lethal dose at one bite. The Echis however rarely gives a sufficient dose to kill an adult man.

Death from a cobra bite has occurred in as short a time as 20 minutes, but may be delayed as long as 30 hours.

The antivenine produced at Kasauli is made from the venoms of cobras and Russell's vipers which are collected at the Haffkine Institute and as these poisons are absolutely specific in their action the antivenine is quite useless against the bites of kraits and phoorsas.

Antivenine should always be given into the veins and not under the skin and if given in the following doses will be instrumental in saving many lives especially if given within a short time of the bite :—

Russell's viper bites	80–160 cc. of antivenine
Cobra bites	100–400 cc. ,, ,,

(*Acton & Knowles*)

Permanganate of potash has little or no effect if rubbed into the bite but generally increases the amount of necrosis and tissue destruction.' EDS.]

XVIII.—THE MOGUL EMPERORS OF INDIA AS NATURALISTS AND SPORTSMEN.

(*Published with the permission of the Director, Zoological Survey of India*).

Mr. Salim A. Ali has done a great service to science in bringing together all references to animals contained in the works of the Mogul Emperors of India and in arranging them in a systematic way. No. 2 of volume xxxii of the *Journal of the Bombay Natural History Society* recently published, contains an account of fishes (pp. 268, 269) as described by these emperors. The descriptions are in almost all cases sufficient to enable the animals to be identified fairly closely. Mr. Ali has, however, not been able to do full justice to these descriptions in his interpretations and I therefore propose to add a few comments to the various passages quoted by Mr. Ali.

Babur refers to the fish of India as follows : 'Their flesh is delicate and they have few small bones. They are surprisingly active. On one occasion a net was laid in the river from side to side. Each side of the net was then raised a *gaz* (2½ feet) above the water, yet many of the fish leaped one after the other a full *gaz* over the net and escaped. There are besides in many rivers of Hindustan small fishes which if they hear a harsh sound or the treading of a foot instantly leap a *gaz* or a *gaz* and a half out of the water.'

There is no doubt that in the description of the flesh a reference is made to our larger marketable fish such as *Labeo rohita*, *Catla catla*, *Cirrhina mrigala*, *Barbus tor*, etc. The active species referred to as leaping is probably *Catla catla* (Ham. Buch.). Buchanan Hamilton writes about this fish as follows : 'It is a very strong active animal, and often leaps over the seine of the fishermen, on which account, when fishing for the *catla*, they usually follow the net in canoes, and make a noise by shouting and splashing with their paddles.'[1] I watched big specimens of *catla* leaping over nets at Niazbeg near Lahore in 1919. It is a common sight in Bengal (probably in other parts of India also) to see small fish leaping about on the surface of the water during a heavy rainfall, probably they react to the noise or disturbance produced by the falling rain. These small fish are usually the young of the species enumerated above.

Another reference in Babur's account runs as follows : 'One fish is the *kakeh*. On a line with its two ears issue two bones, three fingers-breadth in length. When caught it shakes these two bones which return a singular sound, whence they have given this fish its name of *kakeh*.' About the identity of this fish Mr. Ali remarks, 'The identity of a fish described by Babur in the following terms is a mystery. Sir Lucas King has made no comment on it, and it is surprising that such a singular animal, if it exists, should not be generally known. I can find no reference to anything like it in Annandale's paper either.' I have, however, no hesitation in stating that this mysterious creature is *Rita rita* (Ham. Buch.), which is a common fish at Lahore in winter and is called *Khagga.* One often hears hawkers in the streets selling *Ravi dê Khagge* (*Khagga* fish of the Ravi River). In a collection of drawings by Sir Alexander Burnes made during his expedition to Cabul in 1837–38 and recently described by me in the *Journal of the Asiatic Society of Bengal* I[1] find that this fish is called *Kagâ* at Hyderabad and there seems to be no doubt that *Kakeh* is the same as *Kagâ.* Moreover, the structure and the habit described by Babur exactly tally with those of *Rita rita.* In this species the pectoral fins are provided with very strong spines which are denticulated at both edges. They correspond to the two bones described by Babur and their length would depend on the size of the fish examined. These pectoral spines along with the powerful dorsal spine are used as organs of offence and defence and it is well known that the jagged spines of some of our Siluroids (cat-fishes) occasion intense inflammation and sometimes inflict dangerous wounds. During the winter season the individuals of this species hide themselves among pebbles and rocks in crevices and lie in such situations more or less in a state of torpor. At this season they are usually caught in great numbers by hand by diving to their places of retreat and holding them, when caught, in such a position that they are unable to move their spines. This is accomplished by holding the fish between the fingers in such a way that all the three spines stand erect. The spines of the catfishes are very much feared and they are broken off as soon as the fish are caught.

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[1] Day, *Fishes of India*, p. 553 (1878).

At Lahore *Rita rita* is sometimes called *Trikanda,* in which reference is made to the three spines of the fish and in the vernacular name *Khagga* I believe reference is made to the jagged condition of the spine, because the thorny budding leaf of the date-palm tree is also called *Khagga,* at least in the Gujranwala District of the Punjab. The dialect changes from district to district in the Punjab and I know that in this part of India the fishermen are often unable to explain the meanings of the vernacular names of fish.

The pectoral spines of *Rita rita* are provided with a set of very strong muscles and their proximal ends are specially modified to form a movable joint with the pectoral girdle.[2] When the fish vigorously shakes its pectoral spines, on being annoyed, a peculiar noise is produced by the movements of the condyles of the spines in the articular grooves. These facts are closely in accord with Babur's description of *Kakeh.*

The *Pulwah* of Sind is now called *Hilsa ilisha* and not *Clupea ilisha.* Mr. Ali observes that this species 'regularly ascends the Indus in February and March in enormous swarms for the purpose of spawning.' While travelling in the Punjab in 1926 I was informed by a reliable authority that these fish do not ascend in the Indus to the distance and in the quantities which are referred to in earlier records, and he actually feared that this highly-prized fish of Sind was in the process of abandoning the Indus altogether. Exact information on this point will be of immense economic importance.

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[1] Hora, *Journ. As. Soc. Bengal* (n.s.) vol. xxii, p. 123 (1927).

[2] Hora, *Rec. Ind. Mus.*, vol. xxii, p. 30 (1921).

Jehangir's reference to the blind fishes of Andha Nag in Kashmir is very interesting. I do not know of blind fish from the freshwaters of India and it is to be hoped that any one who finds them in Kashmir or elsewhere in India will send them to the Indian Museum, Calcutta, for determination.

Jehangir mentions that, ' The best fish in Hindustan is the *Rohu* and after that the *Barin.* Both have scales and in appearance and shape are like each other. Everyone cannot at once distinguish between them. The difference in their flesh also is very small but the connoiseur discovers that the flesh of *Rohu* is rather more agreeable of the two. ' Mr. Ali identifies *Rohu* as *Labeo calbasu* and suggests that the other may be the Indian Trout (*Barilius bola*).

Rohu is a name which is sometimes indiscriminately applied to the larger species of carp inhabiting our rivers, these may be *Labeo* or *Barbus.* I find (Hora, 1927, p. 124) that at Peshawar *Rohoo* is applied to a species of *Labeo* probably *dyocheilus* (McClell.) and at Hasan Abdal *Rūhu* is used for a species of *Barbus*, probably *tor*. Elsewhere in northern India and in the provinces of Bengal, Assam and Bihar and Orissa *Rohu* is used for *Labeo rohita* and to the best of my knowledge is never used for *Labeo calbasu*, which on account of its characteristic black colour is known as *Kalabasu* in Bengal. In the Punjab and Sind it is called *Di* and *Di-hee* respectively. *Rohu* (*Labeo rohita*) is considered to be a great delicacy and the Emperor Jehangir in all probability refers to this fish.

The vernacular name *Barin* is new to me and it is only by a process of elimination that I can identify it as *Cirrhina mrigala.* There are four scaly fishes in the Indian rivers that are highly prized for the flavour of their flesh and which grow to a fairly large size e.g., *Labeo rohita*, *Catla catla*, *Cirrhina mrigala* and *Barbus tor. Catla* can be readily distinguished by its characteristic upturned mouth. Connoiseurs always find that the flesh of *Barbus tor* is much better than of any other fresh water fish of India and moreover the form of *Barbus tor* is not as deep as that of *Labeo rohita* and the two can also be distinguished by the form of their heads. *Cirrhina mrigala* is very much like a *Labeo* and one is likely to be confused by the two forms ; so it is probable that *Barin* refers to *Cirrhina mrigala.* It could have no reference to the Indian Trout (*Barilius bola*) which in its characteristic shape, markings and the position of the fins, etc., is quite distinct from any species of *Labeo* or the other carp named above.

There is no doubt that the Mogul Emperors of India (Babur and Jehangir) were careful students of nature and the descriptions of the animals that they have left behind them, though meagre, fully testify to this. I hope students interested in other groups of animals will further elucidate the facts so ably brought to light by Mr. Salim A. Ali.

ZOOLOGICAL DEPARTMENT,
UNIVERSITY OF EDINBURGH,
December 24, 1927.

SUNDER LAL HORA,
D.SC., F.L.S., F.Z.S.,
Zoological Survey of India, Calcutta.

XIX.—THE EFFECTS OF BEE VENOM

Reprinted from 'The Indian Medical Gazette,' Vol. LXII No. 5, May 1927

Under the above title Dr. A. R. D'Abreau has an article in the *Indian Medical Gazette* for November 1926, and as a few very striking cases have come under my personal observation, I am publishing this note.

The species generally credited with evil effects is *Apis mellifica*. L. Brant and Ratzeburg were the first to study bee venom in 1833. Paul Bert in 1865 and Carlet in 1884 also studied it, but it was not till 1897 that the chemical nature of the poison was carefully studied by Langer.

This poison when freshly extracted is a transparent acid fluid with a bitter taste and an aromatic smell. The acid reaction is believed to be due to formic acid.

Langer's experiments show that the active principle is not an albuminous but an organic base.

The poison is destroyed, or its activity lessened by the action of oxidizing agents.

Castellani and Chalmers (2nd edition) write 'Intravenous injections into dogs produce convulsions, trismus, nystagmus, emprosthotonus, death from respiratory failure. This action is believed by some authors to be due to a neuro toxin, but the blood after death is very fluid, and the red corpuscles are destroyed, indicating a marked hæmolysis, while all the organs except the spleen show hæmorrhage and hyperæmia, so that the effect may not be due so much to the action on the nervous system, as to that on the blood. With regard to the hæmolytic action Morgenroth and Capri have shown that there is a similarity between this poison and cobra venom.'

The constituents of this poison are :—

1. An inflammatory poison, said to be derived from the acid gland.
2. Neurotoxins ; (*a*) convulsive, (said to be derived from the alkaline gland) ; (*b*) narcotic (secreted by the acid gland).
3. Hæmolysins.

Let us now for a moment study the poison apparatus of a bee.

From the posterior end of the abdominal segment projects a chitinous sheath which contains two barbed darts which form the sting. Into this sheath and connected with the darts two (sometimes three) ducts from glands open. The principal duct belongs to the acid gland and opens anteriorly into a sac which is a reservoir for the poison and which leads to a slender coiled tubular gland which may be bifid or even divided into three. This is a very long gland ramifying amongst the contents of the abdomen. The second opening belongs to a small irregular tubular gland called the alkaline gland, or gland of Dufour.

Now bearing in mind that different trains of symptoms are caused as the result of stings, I think it is safe to infer that the two darts can be used independently of one another. When on the other hand a bee is very angry and attacks with force, both darts are used and the full amount of poison possible for ejection is injected. It should also be remembered (at least this is my idea), that all the bees which apparently attack one do not sting, but the majority generally settle for a second or so and then fly off.

The following cases will I hope illustrate my points :—

Case 1.—In September last an elderly woman in the female ward was stung by a bee at the external canthus of the left eye one afternoon. The Sub-Assistant Surgeon who happened to be in the ward at the time reported that the bee deliberately attacked this patient and would not be driven away until it had stung her. In about an hour's time there was a considerable amount of swelling and ecchymosis over the forehead, left temple, left side of the face, and both eyelids were puffy. At first sight the patient presented the appearance of erysipelas. There was a great deal of pain, a rise of temperature to 101°F. and pulse of 112 per minute. By next morning all the physical signs had greatly diminished and by evening there was no need to consider this part of the patient's illness.

Case 2.—A few days after this occurrence, my wife, son and myself were sitting in the garden, when my son was stung on the back of the neck ; but all that happened in his case was the formation of a little lump (nodule) and a slight red blush about 2 inches in circumference, and this all disappeared in a couple of hours.

This bee did not make a determined attack.

Case 3.—In December 1917 when we were encamped on the Rouvouma River in Portuguese East Africa, a swarm of bees one morning attacked the camp, and 'M', a young chemist who had only recently joined us as a dispenser from Scotland, was most furiously set upon. Some hundreds of bees at a time settled on his head, face, neck, and hands. He became frantic in his endeavours to drive them off and in fact, fright and pain were soon followed by exhaustion, and later on by a good deal of collapse.

In about 3 or 4 minutes the bees had all flown away, and then we extracted about 40 or 50 stings from 'M' mostly from the back of the neck. The face, neck and scalp soon became very red and swollen, and later on a slight œdema was noticed.

This stinging had taken place at 9 a.m. and by 2 p.m. 'M' had temperature of 102°F. and complained of a constricted feeling in the head. During the day he had one or two loose stools, which I attributed to fright as he was a very nervous man. Next morning he felt a 'bit cheap', the neck still showed a slight swelling, but by evening this had gone and he felt quite fit.

Judging from the number of bees that settled on this man, the number of broken stings we found, his method of knocking them off and, finally, the symptoms of poisoning he exhibited, I do not believe that less than one-eighth or more of the bees that settled on him, stung him.

I had often been told that if a swarm of bees are around and you happen to be their line of flight just stand perfectly still and quiet and they will not attack, while the moment you start driving them off by swinging your arms about, the stinging begins, and this was amply proved in this instance. I was not more than four yards away from 'M' when the bees were flying past and I just shouted out to him to keep still and then remained quiet and motionless. Innumerable bees came around me and some actually settled on me and though the temptation to drive them off was great, I did not do so but waited for them to go off on their own, while 'M' on the other hand completely lost his head, with the result that the bees soon concentrated all their energies on him.

Case 4.—Another instance occurred one afternoon under the Kosi Bridge, a few miles out of Kursala in the Bhagalpore District in January 1919. A party of us were in butts scattered along a wide strip of sand awaiting the return of demoiselle cranes from the fields. No one had informed us that there was a huge beehive under the bridge, and 'K' of the Police had his butt not more than 30 yards away from this. As the cranes came sailing past a regular *feu de joie* started but very soon gave place to most awful yells from 'K'. He was soon racing across the strip of sand to the river with a thick swarm of bees about, around, and behind him. Seeing his plight, one of the party to divert the attention of the bees fired a charge of small shot into them and at the same time got his gun boy to throw as much sand as possible into the air about 10 or

15 yards away from him. I do not know the virtue of this procedure but it certainly had the desired effect, for almost immediately the bees left him and flew back to the hive.

Now comes the interesting point. 'K' had one sting on the forehead but from the back of the neck to over the occipital region he must have had fifty or more (I am writing from memory).

The back of the neck is for some reason a specially selected site for stinging. It may be that when attacked one 'ducks' one's head to protect the face and eyes, but this by no means affords a full explanation.

The tsetse fly also selects the back of the neck and the popliteal space.

'K' complained of a burning sensation and a certain degree of vertigo. In a short time the affected area was swollen, red and hot, but 'K' was as hard as nails and no further symptoms developed.

PORT BLAIR, A. BAYLEY DE CASTRO,
May 5, 1927. *Junior Medical Officer.*

XX.—PLANTS AND INSECTS

Jane Austen in one of her novels released a simple but effective thought by making one of the characters exclaim: 'And now you love a hyacinth, so much the better, you have gained a new source of enjoyment, and it is as well to have as many holds upon happiness as possible.' In other words the observation of the symbiosis or close relationship between insects and plants and the place of a plant in its natural classification may sometimes be at once inferred by the insects who are its guests. Thus a beautiful golden green shield bug (Chrysocoris) in Southern India is frequently seen on the leaves of *Jatropha curchas* and in Calcutta a brilliantly coloured bug of the same genus is found on the leaves of *Acalypha indica* also a plant of the Euphorbiaciæ. Sometimes an interesting phenemenon of insect life is witnessed and related by a lucky observer in vivid, impressionistic prose leaving his readers in the dark as to the true identity of the objects described unless gifted with the powers of observation of a Sherlock Holmes.

Extracts in illustration will be quoted in full from their exceptional interest for the guidance of others in the future who have the opportunity of observing similar phenomena in Indian insect life in the localities referred to by the writers quoted. Mark Thornhill in *Haunts and Hobbies of an Indian Official* remarks, 'There are in India many varieties of insects that when they place themselves in certain positions on plants or shrubs appear to be part of the vegetation. Many of them have been described but to realize their wonder they must be seen—one moment a twig, a leaf, or a flower the next moment a moth or a grasshopper. The most marvellous of these transformations that I ever beheld was at the commencement of the ascent from the valley of the Dun to Mussoorie. The lowest part of the road is exceedingly bare, hot and dusty. Along its outer edge there grew a row of extremely small shrubs hardly much more than half a yard in height. The shrubs were always covered with a profusion of white flowers much resembling 'immortelles'. In appearance they seemed as hard and dry as the road itself. I had often noticed these flowers and one day I enquired of my servant what was the name of these flowers and where else they grew for I had never seen any exactly like them before. The man looked surprised at my question and enquired what flowers I referred to, for he added there were none there. I pointed to the shrubs. He smiled, walked to one of them and touched it with his stick. Instantly the flowers vanished. I saw a tuft of bare twigs, and the air was filled with a perfect cloud of small white moths. They flitted about for a time and gradually alighted and the twigs were covered with white flowers as before.' No doubt Thornhill when he wrote these lines fancied what he saw to be a case of protective insect mimicry but it is a characteristic of some members of the order Rhynchota (which includes the cicadas, lantern-flies, the quaint little-horned monsters known as Membracids, and other small moth-like forms) to collect in gregarious patches on the surface of the epidermis of the plant selected as a host and whose life juice they are tapping and the insects seen by Thornhill were not moths but *Lawana conspursa*. The specific scientific name a ' scattering together ' is very apt from the simultaneous fight of the insects when suddenly disturbed. The familiar brown mango-hopper has a similar habit of sudden dispersion when rudely disturbed on mango leaves. The host plant was probably *Plectranthus ternifolius* or *rugosus*, a small shrub of the order Labiatæ common on base hill sides. The leafless condition of the twigs indicated the sapping of the plants by their insect guests. Tragic indeed was the drama of insect life on a species of wild caper (either *Capparis aphylla* or *spinosa*) witnessed by the eyes of Phil Robinson in the vicinity of Delhi and graphically described by him in the following words: 'Everyone has read of the great flights of butterflies that have astonished travellers. Great flights that cloud the sun as they pass overhead, that drive their way even against the wind and do not hesitate at the ocean itself. Right out in the ocean these flights of suicides are sometimes met with, but whence and whither they come and go men of science cannot tell. Now at the foot of the gate-way near the Kutab-Minar, eleven miles from Delhi grows in profusion a thorny shrub, the same that amuses the camels and goats among the ruins of the Futtehpur Sikri Hill, and on the particular morning we were there the whole thicket was alive with white butterflies. I went down to examine it, and such a sight I never saw before. Each bush was alive with the insect in every stage, the chrysalides were so thick in places that they touched each other, and while I watched they hatched by scores and hundreds. I picked a spray of them, and in half an hour the wings were strong and the butterflies were flown. In my hands there remained a twig with a dozen empty shells. This multiplication of life was simply awful. Every other leaf had a caterpillar feeding on it, and among the caterpillars the mothers of the next generation were busy laying their eggs. The bushes were literally alive. And not a butterfly left the place of its birth. As soon as its wings were strong enough to carry it, it hovered about the shell it had just left, and in a minute or two found its mate and thus all on one inch of a twig the life was lived from egg to caterpillar, from caterpillar to chrysalid, and from chrysalid to butterfly. Death was all prepared for them by the side of their cradles. Noticing that in very many cases the butterflies did not move when I came near I picked up one with my hand from the spot on which it seemed to be resting, and then I discovered the horrible secret of its apathy. A spider was holding it to the branch—a beautiful pale green spider—and my eyes opened. I soon became aware of the multitudes of the same kind that swarmed among the butterflies. I waved my hand over a bush. A hundred butterflies might rise from a branch but a hundred would remain motionless. A spider had hold of each. To give you an idea of the enormous creation and destruction that was going on in this patch of scrub that morning I saw what I mistook for a birds' nest, a globular mass of web pendant from a twig. On taking it off I found it was only the web of a common spider and that it weighed as nearly as possible half a pound. It was all dust and spider's web and dead butterflies. And you may calculate if you like how many dead and sucked-up butterflies go to make up half a pound. Again in a corner just as you have seen dried leaves drifted together by the wind, I saw and sifted with my hands a thick drift of butterflies' wings. There were the remains of tens of thousands.' The butterfly observed by Robinson was *Anaphœis mesentina* or a closely allied pierid. In Western India it is partial to fluttering among the showy white and canary yellow flowers of *Capparis zeylanica*, a habit of which the tree lizard, popularly known as a blood-sucker, is aware. This lizard *Calotes versicolor* lies in wait on the leafy twigs of the plant on the look-out for unwary insects. The lower surface of the hind wings of Anaphæis are sometimes of a yellow tinge. It is perhaps noteworthy that the two lower petals of *Capparis zeylanica* flowers are also yellow and this blending of colours in flower and butterfly must be of a protective nature to an insect poised with closed wings on the corolla of a flower. The green crab-spiders of the genus Thamisus are perhaps far more deadly enemies to lepidopterine life than lizards or birds. From their cryptic colouring they are difficult to discern either on or in the axils of leaves and sometimes mixed up with the bracts or involucre surrounding a cluster of flowers. On one occasion a beautiful day-flying humming bird moth (*Cephanodes hylas*) was observed hanging by its long haustellum (proboscis) from the leaf bracts surrounding the flower head of a common garden Zinnea. Closer examination revealed the anterior end of the moth's proboscis in the clutches of a green crab-spider snugly ensconced within the flowery receptacle. Humming bird moths are fond of hovering over the blue flowers of *Duranta plumieri* and it was decidedly unusual for one to have fallen a victim at the shrine of a Zinnea. There is also a pale sickly white form of the crab-spider just referred to whose get-up must assimilate with the leaves of the white floretted Zinnea and thus render it just as deadly as the green form just referred to. These spiders are in fact good instances of what is known as 'aggressive protective mimicry.' Their colouring likewise protects them from the attacks of their deadly enemies the graceful restless wasps of the family Pompilidæ who are perpetually on the look-out for spiders and penetrate the inmost recesses of plants in eager quest for their juicy fat-bodied victims.

Y. M. C. A., H. JOUGUET.
WODEHOUSE ROAD.
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XXI.—WEEDS OF THE INDIAN WAYSIDE

To most minds the vegetable organism known as a weed is like the scientific definition of dirt—' matter in the wrong place ' when it obtains a footing in some garden and then over-runs the surrounding country, which it may or may not beautify according to a human standard of æsthetics. But it is in the nature of a weed to grow where it is not wanted. Each of the three great sea-port towns of India has imported its own particular weed. In the swampy country of Calcutta, Assam, and Eastern Bengal it is the lovely flowered water-hyacinth (*Eicharnia crassipies*), that has obtained a firm footing, in Madras *Gamphrena decumbens* is dominant, and in Bombay a species of mallow (*Malachra rotundifolia*). The first named, the water hyacinth, has been met with in Madras growing in sparse patches in pools of stagnant water in the Spur Tank and at Perambur near the large local workshops of that town. On one occasion it choked up the waters of a small tank in the suburb of Royapettah. The water hyacinth grows profusely along the banks of the beautiful Ulsoor Lake in Bangalore where however it is being eradicated, and as regards Bombay it has been seen flourishing in the waters of an old tank on the right hand side of the road from Mora to Uran also in another tank behind the southern slope of the lesser Karanja Hill across the harbour of Bombay. On the whole it does best in Bengal although it is one of those weeds which would spread anywhere where there is a sufficiency of shallow water to enable it to thrive and propagate. So far as is known the only insects that visit the thick clustering flowers are flies and small bees. Butterflies however sometimes visit the blue florets of *Monocharia hastæfolia* but none have so far been seen settling on the far more conspicuous flowers of the water hyacinth. Florets or minute flowers are more to the taste of butterflies, and it must be assumed in the case of the water hyacinth that fertilization is effected through the agency of flies and small bees. Although so frequently referred to in the papers as the pest known as the lilac devil and in measures proposed for its eradication on the waters of districts where it has become a rampant weed, there is strange to say no descriptive account of the plant in any of the older hand-books on Indian botany, a sure indication of its recent introduction into India by some enthusiastic horticulturist who imported the plant on account of the beauty of its flowers (and in Calcutta the water hyacinth is sometimes sold as an orchid by wily Indian plant vendors to those who are not acquainted with its history !) Once seen it is an easy plant to identify. Great rosettes of leaves, growing thickly in shallow water shaped like the heads of rampant green cobras from which is thrown out a flowering stem of about a foot in height enveloped in light lilac blue flowers each flower bearing on the inner side of one of the petals a pollen-yellow hieroglyphic in shape not unlike the head of a spear, can be none other but the famous water hyacinth. The buoyant freely floating bladder-like central root-stalk of the plant fixes itself to the muddy bottom of a tank by numerous hair-like roots which when dried look not unlike dense and clotted masses of course human hair intermixed with the remains of this weed when uprooted and carelessly thrown on the bank of a tank whose surface is being cleared of the pest. It does not appear so far to have been recorded from Northern India.

On alighting at the railway Central Station at Madras and taking a walk in the grounds of the adjoining Peoples' Park, it is at once noticed that large spaces of waste ground are overrun by an insignificant weed of about from 6 inches to a foot in height. The leaves of the plant are of a narrow elliptical contour and of a downy or cottony whiteness on the lower surface, the inflorescence being a terminal white cone-shaped tuft of minute florets. This is *Gomphrena decumbens*, a member of the same genus as the showy purplish-red flowering *G. globosa*, the globe amaranth of gardens. It is pretty evident that the former must have been accidentally introduced into India from its native land Mexico. It is said that the little weed came to India in a round about way from Australia through being included in the fodder grasses loaded on boats conveying horses from some Australian port to India and that it has only established itself at Madras within the last forty years. Nobody seems to know much about it and it is undoubtedly of recent introduction as it has not yet found its way into the pages of Indian botanical handbooks. It occurs but sparingly in Bangalore, where on the other hand another South American weed may be noticed named *Alternanthera echinata.* Creeping along some of the roadsides with leaves of a rounded oval shape and throwing out a spiny inflorescence between the axils which gives it its specific hedge-hog name. De Candolle pithily includes it in his Prodromus under a list of species 'non satisnotæ', but one would like to know something about a plant whose native home is the Argentine Republic that is found straggling about roadsides in Bangalore and Madras. It is of course undoubtedly of accidental introduction having been shipped along with more showy consignments of foreign plants.

Malachra rotundifolia is presumably the large rough-leaved mallow bearing conspicuous yellow flowers growing in dense gregarious patches on low waste lands in and around Bombay. Sometimes white flowers are seen amongst those of normal yellow but the latter it may be added are invariably white inside the base of the corolla of the flower which probably in an unsatisfactory way accounts for the tendency towards albinism in some of the flowers of the plant; Nairne in his flowering plants of Western India gives the impression that the flowers grow in dense heads. It is true that the involucre of three reniform leaves surround a capitulum of five or six sessile flower heads, but of these only one or at most two burst into bloom within the same involucre. In favourable situations this plant if not too crowded will attain a height of four feet, but if growing closely together in dense patches it seldom exceeds a stature of more than two feet. The flowers are visited by butterflies and blue carpenter bees, of the former the species noticed were the Sulphur Yellow, *Terias hecabe*, small blues (family Lycænidæ), the cosmopolitan Painted Lady (*Vanessa cardui*), the green Swallow Tail (*Papilio agamemnon*), and examples of *Papilio aristolochiæ* were observed flying over waste lands where *Malachra rotundifolia* was growing profusely.

The weedy shrubs known as *Lantanas* (family *Verbenaceæ*), now growing wild in most parts of India are also of South American origin. They are easily recognizable from their small white, pink, red and orange coloured florets which grow in dense clusters and which are so attractive to butterflies. There was a spot on the Cooum River at Madras where its banks were over-run with a white and pink flowering *Lantana camara* and on fine mornings these shrubs were visited by scores of fine Trojan butterflies (*Papilio hector*). It was noticed that these insects were flying in a due north to south direction during the months of September and October and some assisted by a favourable following wind must have travelled a good way following the contour of the east coast. The larvæ of this butterfly have been procured at Sivachellum, one of the high peaks overlooking Waltair about 400 miles to the north of Madras. When crossing over from Ceylon to India, this butterfly was extremely common in the adjacent country beyond Dhunoshkodi and Paumbaum. It is also a common Ceylon butterfly. In Bombay the common Lantana is the orange and yellow flowering variety which does not attract as many butterflies as the white and pink flowering form at Madras. Have then butterflies a colour preference sense? It is hard to say. Fritz Muller noticed in South America a Lantana with florets of changeable colour which was attractive to butterflies. He observed that each kind of butterfly was very partial to a particular colour shade in the florets which changed from yellow to orange and from orange to purple in all three stages of colouring. Of course it must be borne in mind that he observed insects and plants in their original natural home. In India the Lantana has been introduced and it can only be asserted with doubtful certainty that butterflies prefer the white and pink flowering form.

H. JOUGUET.

Y.M.C.A.,
WODEHOUSE ROAD.

PROCEEDINGS

ANNUAL GENERAL MEETING

The Annual General Meeting of the members of the Bombay Natural History Society was held on Wednesday, February 29, at 6 p.m., in the Prince of Wales Museum with Mr. H. A. W. Brent in the chair.

The Honorary Secretary announced thirty-one new members since the last meeting.

The appointment of officers for the ensuing year was as follows:—

President: H. E. The Right Hon'ble Lt.-Col. Sir Leslie Wilson, P.C., G.C.I.E., C.M.G., D.S.O.

Vice-Presidents: H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.; Revd. E. Blatter, S.J., Ph. D., F.L.S., and the Hon'ble Mr. J. E. B. Hotson, C.S.I., O.B.E., I.C.S.

Executive Committee—Bombay: Mr. R. D. Bell, C.I.E., I.C.S.; Mr. A. M. Clarke; Sir Currimbhoy Ebrahim, Bart.; Mr. Alwyn Ezra, F.R.G.S., F.R.C.I., F.Z.S.; Prof. V. N. Hate, B.Sc.; Lt.-Col. F. P. Mackie, I.M.S.; Mr. P. M. D. Sanderson, F.Z.S.; Mr. A. Todd; Mr. J. B. Greaves (*Honorary Treasurer*) and Sir Reginald A. Spence, Kt. (*Honorary Secretary*).

Advisory Committee—Moffusil.—Mr. T. Bainbrigge Fletcher, F.E.S. (Pusa); Mr. T. R. Bell, C.I.E., I.F.S. (Retd.) (Karwar); Col. W. H. Evans, C.I.E., R.E (Peshawar); Lt.-Col. F. C. Fraser, I.M.S. (Waltair); Dr. F. H. Gravely, D. Sc. (Madras); Mr. C. M. Inglis, M.B.O.U., C.M.Z.S. (Darjeeling); Lt.-Col. C. H. Stockley, D.S.O., M.C., O.B.E. (Jhansi); Lt.-Col. R. B. Seymour-Sewell, I.M.S. (Calcutta).

THE HONORARY TREASURER'S REPORT

The Honorary Treasurer, Mr. J. B. Greaves, presented the audited accounts for the past year for the approval of members and in a brief explanation stated:—

' You will notice that this year in addition to the usual statement of receipts and payments, the auditors have prepared a Balance Sheet showing the liabilities and assets of the Society as on December 31, 1927.

With your permission I should like to take the Balance Sheet first.

Dealing first of all with the assets side of the Balance Sheet, Furniture stands at Rs. 2,500, a conservative figure when one takes into account that this figure includes the show cases containing the reference collection and the book cases containing the library.

Game Books Account.—The Game Books have been separated from the ordinary publications of the Society, because the Society in this case is an equal partner with the author with regard to any profit which may be made on the sale of the Game Books.

During the year under review Rs. 2,000 worth of Game Books have been sold and this year we hope to do better. We have, as you will observe, created a reserve equal to the balance of the total stock. There is however still a sum of Rs. 5,310 due on account of Game Books. Notwithstanding this if the sales continue at their present rate it is to be hoped that a large portion of this reserve will ultimately be unnecessary.

Other publications.—The figure of Rs. 400 represents only those publications which have been in stock for less than two years. The remaining publications have all been written off although small sums of money continue to come in from these sources.

Expenses on preparation of Bird Charts.—As you are aware, the Society proposes during the current year to publish a series of Bird Charts and Books and the figure of Rs. 697-13-0 represents preliminary expenses in connection with the preparation of these publications.

Advances to staff and on account of Members.—Rs. 78-7-3. A nominal amount.

Investments.—Stand at the very satisfactory figure of Rs. 78,362-8-0 and this figure is considerably below today's market value.

Cash Balances.—A satisfactory figure of Rs. 19,156-12-8.

This concludes the asset side of our Balance Sheet making our total assets Rs. 1,01,195-8-11.

You will notice that we have not taken into account our very complete Research collection, or our stock of old Journals, or our very valuable library.

Liabilities.—Consist of Printing charges. Rs 6,000 is due on account of the current year's Journal and will be paid early in 1928. At the beginning of 1927 we paid Rs. 2907/11 on account of Journals published in 1926. The remaining liabilities are all on account of publications.

Donations for Specific Objects Unexpended.—This is a sum which the Society is holding as a trustee.

Life Membership Fees.—Rs. 42,600 which we have not spent and which represents the whole of the capital sum paid by life members who are still alive, and also the . . . . . of institutions, clubs, etc., compounded subscriptions.

We are left with surplus assets of Rs. 38,116-14-4.

I think you will agree that the Balance Sheet shows that the Society is in a very sound position.

Dealing now with the receipts and expenditure account. This year we have split this up under separate headings.

General Account.—In this has been included all the main activities of the Society in connection with the Journal, etc. As you will notice we have finished up the year with a statisfactory surplus on this head of Rs. 1,663-7-3.

Publication Account.—Here we have a small deficit of Rs. 111-8-10.

Special Expenditure in connection with Prince of Wales Museum and Nature Study.—The whole of the expenditure under this head has been met by special donations including during the year, very handsome donations of Rs. 5,000 each from H. H. The Maharaja of Jodhpur and Sir David Ezra, Kt., towards show cases, models, etc., and we finish up the year with a satisfactory surplus of Rs. 7,968-10-7, the sum shown in the balance sheet as being held in trust by the Society.

Cash Account.—This account is merely a summary of the other account with the addition of Entrance fees and Life Membership Fees received during the year with approximately the same amount invested on the other side, and of course the summary of our cash position.

In conclusion I would mention that the Society now consists of 188 Life Members, 1,123 Ordinary Members who have paid their subscriptions and 62 Ordinary Members who have not paid their subscriptions, making a total of 1,373 members in all. During the year we enrolled 12 Life Members, 1 old member rejoined, and 146 new Ordinary Members were elected. There was a net increase in membership of 35 during the year as I regret to state we lost 76 members through resignation.'

It was proposed by Chairman and seconded by Honorary Secretary that the audited accounts of the Society for the past year be approved—*Carried unanimously.*

On the motion of Mr. H. A. W. Brent a hearty vote of thanks for his services was passed to Mr. J. B. Greaves.

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT DECEMBER 31, 1927.

LIABILITIES.	RS A P	A P
Sundry Creditors—		
Printers of 'Game Books'	5,310 0 0	
,, ,, Identification of Indian Butterflies say	1,200 0 0	
,, ,, Journal	6,000 0 0	12,510 0 0
Donations for specific objects unexpended ...		7,968 10 7
Life membership Fees		42,600 0 0
Surplus Assets		38,116 14 4
Total ...		1,01,195 8 11

ASSETS	RS A P	RS A P
Furniture—Estimated cost	7,500 0 0	
Less Depreciation to date	5,000 0 0	2,500 0 0
Game Books Account—		
Cost of publications	65,520 10 8	
Less Realized to date	50,748 0 0	
	14,772 10 8	
Less Reserve for unsaleable stock, etc.	14,772 10 8	
Note.—50% of any profits to be paid to Authors		
Publications. Excluding Journal, at cost ...		400 0 0
Note.—Any publications which have been on hand over two years have been written off.		
Eepenses on Preparation of Bird Charts—		
Carried forward		697 13 0
Advances to Staff and member		78 7 3
Investments at face value or market value whichever is Lower—		
3½% G. P. Notes of Rs. 28,000 at 76/- ...	20,280 0 0	
4% Govt. Conversion Loan Rs. 10,000 at 94/6	9,437 8 0	
5% Govt. Loan (1945-55) Rs. 15,000 ...	15,000 0 0	
6½% Bombay Development Loan 1935, Rs. 8,000	8,000 0 0	
4% B. P. T. Ungt. Bonds Rs. 14,000 at 85/8	11,970 0 0	
4% City of Bombay I. T. Bonds Rs. 15,000 at 84/8	12,675 0 0	78,362 8 0
Cash Balances—		
On Fixed Deposit with Bankers ...	15,000 0 0	
On Current Account with National Bank of India, Ltd., Bombay	1,876 0 3	
,, ,, ,, London ... ... £159-16-2 at 1/6	2,130 12 5	
Cash on hand	150 0 0	19,156 12 8
Note.—A stock of 17,000 old journals and the valuable research collection and library of 2,300 volumes have not been taken into account on the Asset side of the Balance Sheet.		
Total ...		1,01,195 8 11

We have prepared the above Balance Sheet from the cash book and from information given to us, and have verified the Investments and Deposits.

In our opinion such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of the information and the explanations given to us.

BOMBAY, *February 16, 1928.*
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) J. B. GREAVES,
Honorary Treasurer.

GENERAL ACCOUNT

RECEIPTS	RS A P	RS A P	PAYMENTS	RS A P	RS A P
To Subscriptions	28,711 8 10		By Journal Account	7,632 8 7	
,, Postal Registration	378 0 0		,, Salaries	19,946 9 0	
,, Sales of Journals	1,733 1 11		,, General Charges, Petty Cash, etc. ...	1,257 3 9	
,, Receipts from advertisement	370 0 0		,, Rent	2,436 0 0	
,, Payment by Members for mounting, etc.	925 3 4		,, Printing and Stationery	923 2 10	
,, Sundries	203 3 9		,, Postage	1,363 5 6	
,, Interest on Investments, etc.	4,203 1 4	36,524 3 2	,, Library	829 14 3	
			,, Furniture	125 0 0	
			,, Audit Fee	250 0 0	
			,, Fire Insurance	100 0 0	34,863 11 11
			Balance ...		1,660 7 3
Total ...	...	36,524 3 2	Total ...	...	36,524 3 2

PUBLICATIONS ACCOUNT

RECEIPTS	RS A P	RS A P	EXPENDITURE	RS A P	RS A P
To Sales of Game Books	1,985 0 0		By Messrs. Bale Sons and Danielsson, Ltd.	2,966 6 8	
,, ,, ,, Snake Charts	317 4 0		,, ,, Witherby & Co., Ltd. ...	198 6 10	
,, ,, ,, Iraq Fauna	5 14 3		,, Preparation of Bird Charts	697 13 0	3,862 10 6
,, ,, ,, Game Bird Plates	143 7 0				
,, ,, ,, Identification of Indian Butterfly	850 2 3				
,, ,, ,, Snake Books	2 12 0				
,, Other printed matters	446 10 2	3,751 1 8			
Balance ...		111 8 10			
Total ...	...	3,862 10 6	Total ...	...	3,862 10 6

SPECIAL EXPENDITURE IN CONNECTION WITH PRINCE OF WALES MUSEUM AND NATURE STUDY

RECEIPTS	RS A P	RS A P	PAYMENTS	RS A P	RS A P
To Balance Unexpended as on 1st January 1927	6,432 0 6		By Nature Study	4,575 13 0	
,, Donations	10,000 0 0		,, Expenses on Show Cases	3,887 8 11	
		16,432 0 6			8,463 5 11
			Balance to be expended		7,968 10 7
Total ...		16,432 0 6	Total ...	...	16,432 0 6

SUMMARISED CASH ACCOUNT

RECEIPTS	RS A P	RS A P	PAYMENTS	RS A P	RS A P
To Entrance Fee received in 1927 ... —	2,980 0 0		By Investments—3½% Government Pro-Notes of Rs. 6,700	5,033 6 0	
,, Life Membership Fees received in 1927 ...	4,200 0 0		,, Excess Payments over receipts on Publications	111 8 10	
,, Opening Balances	13,608 1 5		,, Advance to Staff and Member	78 7 3	
,, Surplus on General Account	1,660 7 3		,, Amount expended from Donations for Special Purposes	8,463 5 11	
,, Donations for special purposes	10,000 0 0		,, Closing Balance	19,156 12 8	
,, Other Donations	395 0 0	32,843 8 8			32,843 8 8
			,, On fixed Deposit with : The Hongkong and Shanghai Banking Corp. Bombay, 5,000 0 0 National City Bank of N. York Bombay 5,000 0 0 Bank of BarodaLtd., Bombay ... 5,000 0 0 RS A P 15,000 0 0		
			Balance on current account with National Bank of India, Limited, Bombay 1,876 0 3		
			Cash on hand 150 0 0		
			Balance on current account with National Bank of India, Limited, London £159-16-2 at 1/6 ... 2,130 12 5		
			Total ... 19,156 12 8		
Total ...	...	32,843 8 8	Total ..	...	32,843 8 8

BOMBAY, *February 16, 1928.*
Examined and found correct.
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) J. B. GREAVES,
Honorary Treasurer.

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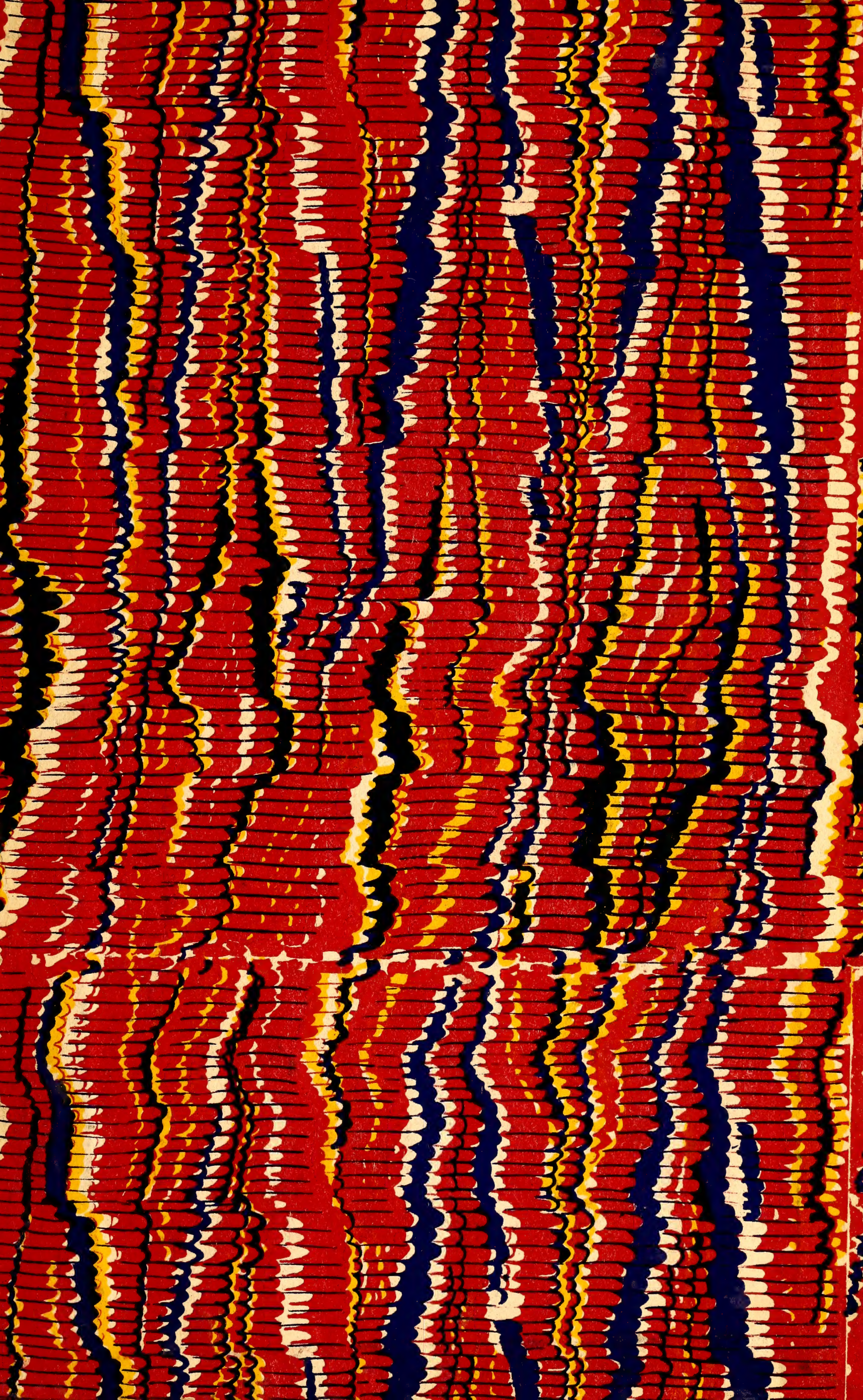

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